PINE BLUFF ARSENAL

SITE 27

BZ POND

SITE CLOSURE PLAN

DEPARTMENT OF THE ARMY
TULSA DISTRICT, CORPS OF ENGINEERS
OKLAHOMA

PINE BLUFF ARSENAL
SITE 27
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SYNOPSIS

Site 27, the BZ Pond, at Pine Bluff Arsenal, Arkansas, will be closed in a FY 86 Military Construction Army (MCA) project in accordance with all applicable Federal and State of Arkansas regulations. The general investigative procedures followed at Site 27 were to establish the extent and nature of contamination from waste materials on the surface, in the underlying soils, and in the pond water and sediments. This included investigations sufficient in scope to determine which contaminants would classify as hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA).

The contamination at this site is associated with remnants of and residues from: thermite disposal, bomb washout, BZ agent production wastes and impregnite process wastes which were piped into the pond or disposed on the ground surface at the site. Contamination is limited to the area immediately adjacent to the pond, sediments in the pond, a drainage path located to the northeast of the pond, and a drainage path south of the pond. Primary contaminants throughout the site area are barium, chromium, and lead. A limited number of organic contaminants also exist at the site but are limited to the pond sediments. The recommended closure plan for this site is twofold: (1) removal of contaminated pond sediments (RCRA waste) for solidification and disposal into the hazardous waste landfill, and (2) construction of a slurry wall around the pond to isolate the remaining contaminated materials (non-RCRA waste) from the environment. This closure plan is considered to be the most technically, economically, and environmentally acceptable alternative based upon the data presented in this report.

I - GENERAL

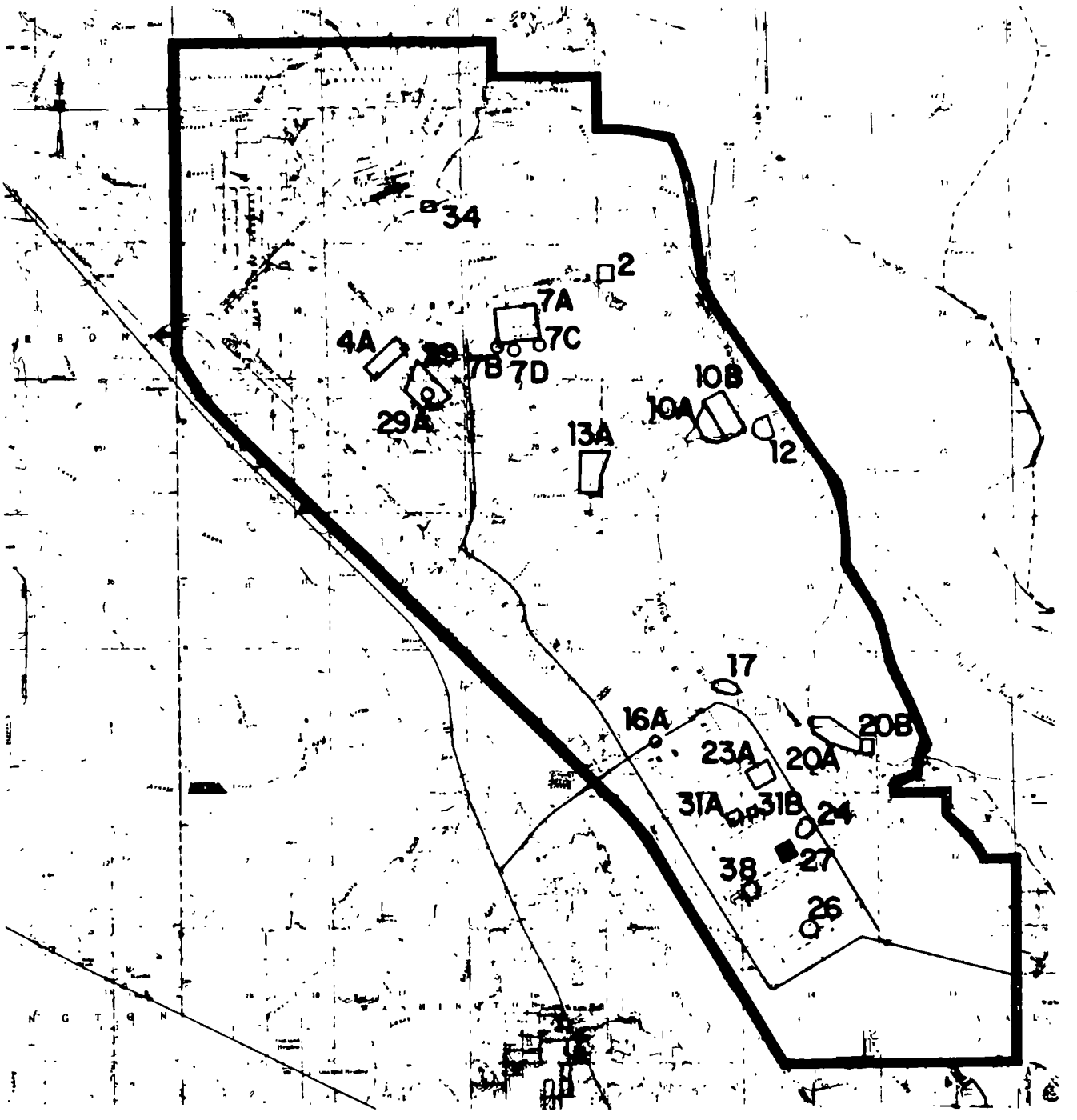
1-01. Purpose. This report presents the closure plan for contaminated waste materials located at Site 27, the BZ Pond, at Pine Bluff Arsenal, Arkansas. This site is an inactive site and will be permanently closed in accordance with applicable State and Federal regulations. Closure of this site is required to eliminate an historical open dump and prevent contamination of the waters of the State of Arkansas. Discussions between Arkansas Department of Pollution Control and Ecology (ADPCE), Pine Bluff Arsenal (PBA), and Tulsa District, U. S. Army Corps of Engineers personnel determined that both the Resource Conservation and Recovery Act (RCRA) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) procedures would be applicable to the closure of the site.

1-02. Report format. A site description is presented in Section 2. The geotechnical investigations which form the bases for the proposed closure plan are contained in Section 3. A description of the proposed closure plan for this site is presented in Section 4. The indicated closure plan is considered to be the most technically feasible, cost effective, and environmentally acceptable alternative based on the results of geotechnical investigations and existing site conditions. An alternative closure plan considered for this site is presented in Section 5. A cost estimate for closing Site 27 is presented in Section 6.

II - SITE DESCRIPTION

2-01. General. Site 27 will be closed in the FY 86 MCA project, "Hazardous Landfill/Closure Sites." Subsurface information, as described in Section 3, was obtained at the site to develop the most suitable closure plan. Pond sediments were found to contain all 8 RCRA-listed heavy metal contaminants plus some of the priority pollutant organic compounds. Fill materials and soils around the pond were found to be contaminated primarily with barium, chromium, and lead. Approximately 10,000 cubic yards of contaminanted pond sediments, fill materials, and soils are estimated to exist at the site. Two closure schemes were investigated for this site, these being (1) removal and disposal, and (2) encapsulation in place utilizing a natural lower clay boundary.

2-02. Site Description. Site 27, the BZ Pond, is a one-quarter acre pond located within a fenced enclosure inside the PBA production area (see Figure 2-1). The pond bottom is unlined but sections of the side slopes are stabilized with large concrete blocks. A small drainage entering the pond from the south and west, and a stream leaving the pond from the north and east are also considered part of the site and are addressed in the closure schemes. The first use of the pond was in the 1940's when thermite waste was deposited. The amount of thermite is unknown but may be as thick as 10 feet. Also in the 1940's, a bomb wash facility was constructed south of the pond (building 32-570) and was connected to the pond by a concrete-lined ditch. In this building, bombs (primarily thermite rounds) were opened and the starter mix, a red lead mixture, was washed out and into the pond. This operation continued until the mid 1950's. In 1959, existing stocks of World War II thermite rounds were washed out at this facility. From February 1963 to June 1966, the pond was used for BZ production waste. BZ is an organic compound, 3-quinuclidinyl benzilate, which is a hallucinogen. The BZ production waste was treated with heat and caustic and piped to the pond from building 32-530. Untreated water from the BZ workers' daily showers and from the laundering of their work clothing was piped into this same production waste line leading to the BZ pond. Cyclohexane, a carrier for the agent, was also disposed of in the pond. From 1968 to 1970, the pond again received wastes from occasional use of the bomb wash facility. In 1970, the bomb wash facility was converted to an impregnite plant. Impregnite is a chloroamide compound in a paraffin binder once used in the clothing of combat troops. Wastes from the impregnation process were piped into the pond until 1972. The pond has not been used since 1972 and currently retains about 10 feet of water.



LOCATION MAP

FIGURE 2-1

III - GEOTECHNICAL INVESTIGATIONS

3-01. Introduction. The purposes of the exploration program were to (1) determine the location and properties of any clay strata beneath the site that would be acceptable for use as a lower impermeable boundary in an in situ encapsulation scheme and (2) define the type, severity, and lateral and vertical extent of contamination.

3-02. Field investigations.

a. Preliminary. Prior to recent investigations at Site 27, 23 holes were drilled at the site for the 1973-75 Contaminated Area Survey Project and sampled to a depth of about 12.5 feet. The samples were tested for heavy metals and other contaminants. In 1981, one upgradient and three downgradient monitoring wells were installed to monitor groundwater at the site. The wells are regularly tested by the Army Environmental Hygiene Agency for selected parameters. The groundwater data from these wells is available on STORET, a computer system administered by the Environmental Protection Agency. Laboratory classifications of these preliminary soil samples were not made. Monitoring well locations are shown on drawing 1.

b. Current investigations. A total of 34 borings were drilled at Site 27 in 1984. The auger holes were drilled 5 to 40 feet deep around the pond and in the drainages to the north and south of the pond. Boring 27-22 was drilled 450 feet north of the pond and served as a background hole for both Site 27 and Site 24. The pond sediment was sampled in three locations with a ball check sediment sampler from a barge. Water samples from the pond, the perched water table, the permanent water table, and the stream north of the site were also taken. Tests were conducted on these soil, sediment, and water samples for arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver (the 8 RCRA-listed toxic metal contaminants), and zinc (though not a RCRA-listed contaminant). Each run with the auger was limited to 3 feet (shallower near the surface). To prevent mixing of materials or sampling material that had pulled off the wall of the hole, only the interior portion of each sample was used. Material was taken uniformly from the entire sampling zone, sealed in jars (glass jars were used when tests were to be conducted for organic compounds; otherwise plastic jars were used), and shipped to the Corps of Engineers, Southwestern Division Laboratory in Dallas, Texas. If the hole penetrated a clay layer, it was backfilled with grout. Boring and sampling locations are shown on drawing 1.

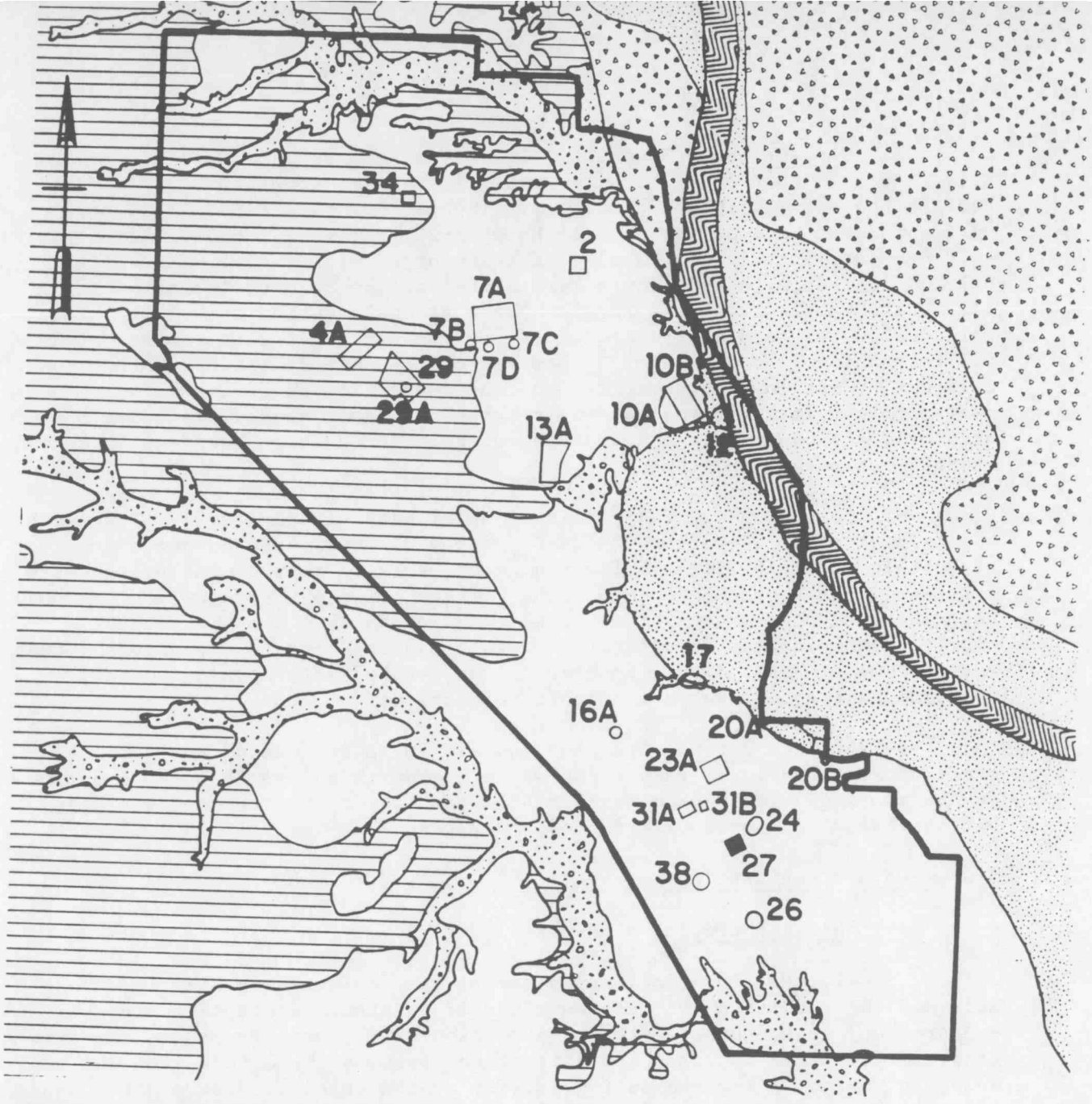
c. Monitoring well changes. Well 154, the upgradient well, monitors the permanent water table. Well 156 is set in the perched water. Wells 155 and 157 were screened in the permanent water table but were reading perched water tables and apparently had bad bentonite seals. Because of the uncertainty about which zone the water samples were reflecting and because of the possiblity of introducing contaminants into the permanent water table, wells 155 and 157 were backfilled with cement grout. Two new wells were installed in the permanent and perched water tables, respectively.

3-03. Stratigraphic results.

a. General. Site 27 is located on terrace deposits of sand, silt, and clay at about elevation 232 NGVD. Figure 3-1 is a map of the geologic environments at PBA showing the location of the site. The Jackson Group, consisting of clay-shale and noncemented to poorly cemented sandstone, underlies the terrace deposits from 16 to 18 feet below the ground surface.

b. Sediments and fill. There are 3 different types of sediments in the pond and another type of fill on the surface surrounding the pond. The uppermost pond sediment is 0.3 to 0.6 feet of a white, sticky sludge from the impregnite process. Below this is a dark gray sludge, 0.3 to 0.5 feet thick, from the BZ manufacturing process. Underlying these sediments, which were very soft and easily sampled, was a very hard layer, most likely from the thermite operation. This layer was sampled with a rotary drill rig backed up to the pond's bank. This material was found to be dark gray in color, and approximately 8 feet thick. On the bank of the pond is a soil-like fill consisting of a clayey sand or gravel which ranges from red, green, dark gray, or black in color. This fill is about 0.5 feet thick on the west bank of the pond, 2 feet thick on the north bank, 5 to 6 feet thick on the east bank, and absent on the south bank. Two geologic sections are shown in drawing 2.

c. Terrace deposits. Terrace deposits, consisting of silty clay, silt, and silty sand, underly the fill except on the east side where the clay is replaced by the deepest portion of this fill. The clay has a liquid limit less than 25 and is a borderline silt. It generally occurs at or near the surface except where it is truncated by the pond and the fill.



GEOLOGIC ENVIRONMENTS

FIGURE 3-1

d. Jackson Group Deposits. Underlying the terrace deposits at the site is a 4.7- to 6-foot thick layer of clay-shale, approximately 18 feet beneath the site, with a liquid limit of about 50. A field falling head test conducted in a 3-foot zone of hole 27-28 yielded a permeability of 1.5 x 10^{-8} cm/sec in this clay-shale. This compares well with a value of 6.3×10^{-9} cm/sec obtained from a laboratory test on an undisturbed clay-shale sample from hole 27-30. The clay-shale varies from 5 to 6 feet thick below the pond everywhere except in the northeast corner where it is 4.7 feet thick (see drawing 3). Because of the uniform nature of the clay-shale, its low permeability, and the absence of significant contamination in the permanent water table of either heavy metals or organics, the clay-shale bed appears suitable for a lower boundary in an in-situ encapsulation scheme.

e. Groundwater. The permanent water table is sloping very gently to the east at about elevation 202 NGVD. Perched water is found above the clay-shale about 14.5 feet below the ground surface in the monitoring wells outside of the fenced enclosure. The borings between the fence and the pond have perched water about 9 feet deep. It appears that the silty sand overlying the Jackson is saturated beneath and adjacent to the pond and that the pond is hydraulically connected to the perched water table. These relationships are shown on the geologic sections.

f. Surface water. The pond contains 8 to 10 feet of water. The east and west banks are very steep while the north and south banks are more gently sloping. The stream north of the pond is dry upstream of the pond but has a flow of about 0.2 cfs below the pond.

3-04. Laboratory testing.

a. Chemical testing procedures.

(1) Metals. Soil and sediment samples were digested in strong acid and the resulting extracts were tested by atomic absorption spectroscopy techniques. With the exception of EP toxicity tests, the acid treatment resulted in total ion extraction, freeing the metals from the soil and pore water. A representative portion of the sample was oven dried and the values reported in milligrams/kilogram (mg/kg) dry weight. Groundwater samples were filtered in the lab and given a similar acid treatment. The results are reported in milligrams/liter (mg/l). In the EP toxicity test, the soil material was treated with a weak acid to simulate natural leaching conditions, then agitated. The resulting extract was tested for ion content with the results reported in mg/l. Laboratory results are included in Appendix I.

(2) Organics. Soil, sediment, and water samples were tested by gas chromatograph/mass spectroscopy (GC/MS) techniques. Selected samples were analyzed for purgeable organics, base/neutral extractable organic compounds, acid extractable organic compounds, and pesticides listed on the August 1980 EPA list of priority pollutants. Analyses were performed by Key Laboratories, and Allied Analytical and Research Laboratories in Dallas, Texas.

(3) BZ Screening. All sediment samples from the pond were screened for BZ at the Pine Bluff Arsenal toxic lab before they were released.

b. Laboratory soil classification. Atterberg limits, sieve analysis, and natural water content tests were performed on selected soil samples by the Corps of Engineers Southwestern Division (SWD) Laboratory. The resulting classifications, based on the Unified Soil Classification System, are used to identify material types shown in the geologic sections presented on drawings 4 and 5. Laboratory visual classifications were used to verify field classifications.

c. Laboratory permeability test. One falling head permeability test was performed in the laboratory on a specimen cut from an undisturbed (denison) sample of the Jackson clay-shale. The test was performed at the Corps of Engineers SWD laboratory. The Jackson clay-shale was being investigated for effectiveness as a lower boundary in an encapsulation closure scheme.

3-05. Analysis.

a. Background level of metal contaminants. In order to define contamination, a background (natural) concentration for each metal contaminant was measured. Because Sites 24 and 27 are very near each other, one hole was drilled between the two sites, and served as the background hole for both sites. Five soil samples from the hole (3 silt, 1 sand, and 1 clay) were tested for arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, and zinc. There was no significant difference in the concentrations of contaminants in the different materials, so all data from silt, sand, and clay was combined. The mean concentration and standard deviation were calculated for each metal contaminant that was present in easurable concentrations. For the metal contaminants that were not present in measurable concentrations, no statistical analyses were made. If data is normally distributed, approximately 95 percent of the data will fall within plus or minus two standard deviations of the mean. The statistical calculations are summarized in table 3-1. Concentrations that exceed the upper limit of this 95 percent confidence interval indicate contamination above background levels. The background levels were found to be exceptionally low and of little use in determining practical limits for soil removal or encapsulation at Site 27. The contaminant concentrations (cleanup limits) to which cleanup would be required in a removal and disposal plan are given in table 3-1.

b. Background level of organic contaminants. No testing for the organic compounds found at the site was performed on the soil samples from the background hole. The organics of primary concern are not naturally occuring and should not be present in any concentration in the background hole.

c. Determining depth of contamination for metals.

(1) Method. The depth of metal contamination was determined by comparing the measured concentration of contaminants with background levels. The depth to which soil would be cleaned up at Site 27 was determined by comparing the measured values of each contaminant with the proposed cleanup values presented in table 3-1. This data is presented graphically for each boring in Appendix II. With the results plotted in this manner the depth of contamination and the depth of soil to be contained or removed is easily determined.

TABLE 3-1

BACKGROUND SOIL CHEMISTRY

(All Values in mg/kg)

SITE 27			
Contaminant	Background Mean	95% Confidence Interval(1)	Cleanup Limit
Arsenic (As)	< 1.0	--	1.5
Barium (Ba)	29.6	100.2	400.0
Cadmium (Cd)	< 0.5	--	1.0
Chromium (Cr)	< 5.0	--	20.0
Lead (Pb)	5.8	13.9	20
Mercury (Hg)	< 0.1	--	0.1
Selenium (Se)	< 0.1	--	0.5
Silver (Ag)	< 0.5	--	0.5
Zinc (Zn)	4.9	14.0	--(2)

(1) An upper limit of the 95 percent confidence interval was not calculated for chemicals which were below minimum reported values in the background.
(2) Since this contaminant is not a RCRA toxic contaminant, cleanup limits are not required.

All fill material is shown as contaminated whether or not samples of the fill were tested.

(2) Procedure for determining laboratory tests. Samples from hole 5 were tested for arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, and zinc. Two RCRA-listed metals, barium and lead, were found to be present in high concentrations, and because barium extended deeper at the site than did any other metal, both were selected for further testing. An EP toxicity test was performed on a sample of fill from hole 5 that had very high total ion concentrations of lead, and fairly high total ion concentrations of barium, cadmium and chromium. The RCRA limits for toxicity were not exceeded in this sample, judged to be most highly contaminated, and no further EP toxicity tests were performed. Test results are presented in table 3-2.

TABLE 3-2

EP TOXICITY RESULTS

(Values in mg/1)

Sample #	Depth (feet)	As	Ba	Cd	Cr	Pb	Hg	Se	Ag
27-5 Jar 1 (Fill)	0-1	0.14	0.50	0.05	0.01	0.21	.0001	.0004	0.01
RCRA limits		5.0	100.0	1.0	5.0	5.0	0.2	1.0	5.0

d. Determining extent of organic contamination. Sixteen organic compounds were identified in the sediment of the BZ pond (see table 3-3). They varied in concentration and specific gravity as well as character. Those with a specific gravity greater than one would be expected to sink in water to an impermeable layer and those with a specific gravity less than 1 would be
expected to rise to the surface of the pond or the phreatic surface. Four holes, equally spaced around the pond, were sampled, and saturated soil samples were analyzed for selected contaminants at three locations as shown in figure 1. The locations sampled were (1) at the top of the perched water table, (2) at the top of the aquitard, (3) and in the permanent water table as shown on figure 3-2. The low concentration of organic compounds in samples from these locations indicates limited migration of organic compounds and demonstrates effective containment of the organic compounds in the pond sediments.

e. Contamination results.

(1) Pond contamination.

(a) Sediments. Three distinct strata of sediments were found in the BZ Pond. A white sludge approximately 6 inches thick overlies a dark gray sludge of about the same thickness. Both sediments overly a hard residue that cannot be penetrated with a power auger but was penetrated with a rotary drill rig. Samples of the sediments were analyzed for BZ, heavy metals and organic compounds. No BZ was found in any of the sediments. All 8 RCRA-listed metal contaminants were present in concentrations above cleanup limits and did not differ greatly in concentration in the sediments. The concentrations were as high as 1 mg/kg silver, 51 mg/kg arsenic, 5500 mg/kg barium, 7.3 mg/kg cadmium, 2000 mg/kg chromium, 5500 mg/kg lead, 1.2 mg/kg mercury, and 11 mg/kg selenium. The organics that were found in the sediments are listed in table 3-3. The white sediment is highly contaminated with primarily 1,1-dichloroethylene and tetrachloroethane. The gray sediment contains the same compounds for the most part, but in lesser concentrations. Approximately 250 cubic yards of these sediments are present at the site.

TABLE 3-3

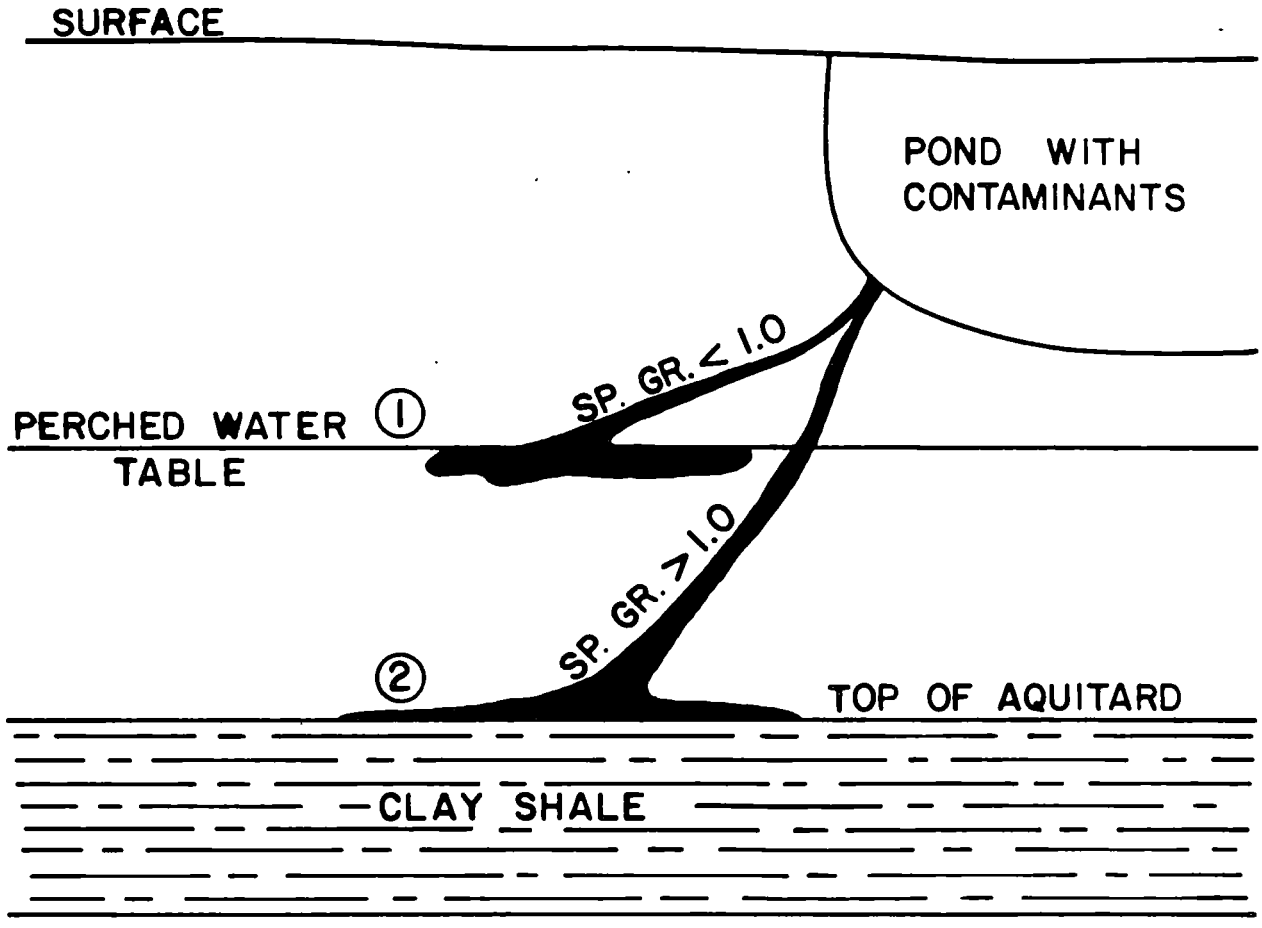
ORGANIC ANALYSIS OF SEDIMENTS

Compound	Specific Gravity	Organic Concentration (Hole 27-26)		
		White Sediment (0-0.3 Ft) mg/kg	Gray Sediment (0.3 - 1.0 Ft) mg/kg	Water mg/l
Purgeable organics				
1,1-Dichloroethylene	1.22	996	230.3	
1,2-Dichloroethane	1.26	1.638	0.193	
Trichloroethylene	1.35	4.97	2.189	
Tetrachloroethylene	1.60	2,310.0	425.263	
Chloroform	1.49	134.0	4.451	
Carbon tetrachloride	1.58	3.206		
Trans-1,2-Dichloroethylene	1.27		0.229	
Benzene	.88		0.030	
Toluene	.86		0.123	0.031
Chlorobenzene	1.11		0.143	
Ethylbenzene	.87		0.060	0.112
1,1,1-Trichloroethane	1.35			0.022
Base neutrals				
Hexachloroethane	2.09	9.804		
Naphthalene	1.15	26.006		
Di-n-butyl phthalate	1.05	4.903	3.122	
Bis(2-Ethylhexyl) phthalate	.99	14.417		0.020
Acid extractables		None	None	None
Pesticides		None	None	None

(b) Pond Water. Water samples were taken from both the surface of the pond and near the sediment/water interfaced and analyzed for metals. Since most of the organics present are heavier than water the bottom water sample was analyzed for organics. Organic chemical analyses are presented in table 3-3 and metal analyses are presented in table 3-4. Approximately 450,000 gallons of water are present in the pond. Three contaminants are present in the pondwater. Barium is present in concentrations greater than the water quality standard of 1.0 mg/l. Lead is present in the bottom sample at a concentration greater than the water quality standard of 0.05 mg/l. Also 1,1,1-trichloroethane is present in a concentration of 0.022 mg/l, which is much less than the unofficial standard (California action level) of 0.3 mg/l.

TABLE 3-4
METALS ANALYSIS OF POND WATER
(Results in mg/l)

Sample	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn
W-1 (surface)	.01	.001	9.64	.02	.01	.0001	.01	.004	.17
26 WS-1 (bottom)			4.5	.008	.01		.07		.01



TYPICAL SUBSURFACE PROFILE

FIGURE 3-2

(2) Fill around the pond and underlying soil.

(a) Metals. A red, sandy fill is present on the banks of the BZ pond. The fill extends approximately 50 feet east and north, and 10 feet west, of the pond. Contaminated soil is present to a greater lateral extent than the fill. The horizontal limits of the contaminated soil or fill are shown on drawing 2. An isopach of the contaminated materials is also shown on drawing 2. The majority of the area is covered with 1 to 2 feet of contaminated soil, and the deep contamination is confined to the area immediately around the pond. The primary contaminants are lead and barium. Lead concentrations range from 10,000 mg/kg in the fill to 180 mg/kg in the soil. Barium concentrations range from 6500 mg/kg in the fill to 2200 mg/kg in the soil. The lead contamination is confined to the fill and the first two or three feet of soil directly beneath the fill. Barium is present to a greater lateral and vertical extent, and is present in the drainages entering the area. In holes 5 and 28, barium was higher than the cleanup limits in a soil sample obtained from a depth of 36-40 feet, the location of the permanent water table. These anomalies could have been caused by two nearby monitoring wells which were improperly sealed and leaking perched water down the well into the permanent water table.

(b) Organics. Two or three samples from the representative zones shown in figure 1 were analyzed for 1,1-dichloroethylene, tetrachloroethane, hexachloroethane, napthalene, and toluene. Samples were taken from holes 5, 28, 29, and 30. The organic compounds chosen for further analysis were selected because of their high concentrations in the pond sediments and their variety of specific gravities to see if any difference in location and concentration was noticed. Results are presented in table 3-5. The concentrations of these compounds detected in these holes were minute, and of no environmental hazard. The pond is effectively preventing migration of the organic compounds.

(3) Stream north of BZ pond. The drainage stream north of the BZ pond flows to the east for approximately 500 feet to a confluence with a larger stream flowing past Site 24. Cleanup of Site 27 will end at this confluence. Contaminants identified in the soils of this streambed were lead, chromium, and barium with concentrations as high as 1500 mg/kg, 900 mg/kg, and 3500 mg/kg, respectively. Vertical extent of contamination above cleanup limits is confined to the upper 6 feet of the steambed. The horizontal extent of contamination is limited to a 20-foot width centered along the flowline of the streambed.

(4) Contaminated material quantities. The total quantity of contaminated material at the site is approximately 10,000 cubic yards (assumes a 10-foot depth of contamination beneath the pond). Of this amount, approximately 250 cubic yards are the contaminated viscous pond sediments, and approximately 9750 cubic yards are heavy metal contaminated fill and soils.

Table 3-5

RESULTS OF ORGANIC ANALYSES OF SOIL
(all results in mg/kg)

Hole	Jar	Depth (ft)	Location Code (see fig 3-2)	1,1-Dichloroethylene	Tetrachloroethane	Hexachlorethane	Napthalene	Toluene
5	8	9-12	1	2.2	.01	.005	.15	.05
	10	15-18	2	1.2	.02	.01	.25	.16
	18	36-40	3	.71	.01	.005	.15	.06
28	6	7-10	1	.68	.06	.005	.15	.08
	10	15.5-17	2	.07	.01	.005	.15	.02
	19	39-40	3	.59	.02	.02	.15	.06
9	9	13-16	1	.51	.01	.005	.15	2.3
	10	16-17	2	.38	.01	.005	.15	2.3
10	6	9.5-10	1	2.2	.03	.07	.15	.1
	10	17.5-17.8	2	.65	.02	.005	.15	.23

(4) Groundwater Contamination.

(a) General. Groundwater encountered at Site 27 belongs to the Jackson/Quaternary acquifer. This aquifer generally yields small amounts of low quality water and is not used for any water supply purpose in the vicinity of the arsenal. Drinking water in the area is supplied from the Sparta Sand which is about 600 feet below the site and is separated from it by low permeability Jackson and upper Claiborne groups.

(b) Perched Water Table There are two distinct water tables at this site. The perched water table is present on top of the clay-shale and is fed by pond water and surface infiltration. One monitoring well (156) is set in the perched water table and a water sample was obtained from auger hole 5 in the perched zone. In the auger hole water sample, barium was present in concentrations above the drinking water standards, and lead was present in detectable concentrations but was not above drinking water standards. No metals were found in well 156 in 6 rounds of sampling over 2 years that were not found in the upgradient well. The perched water is probably contaminated to some degree because of the apparent hydraulic connection between the pond and the perched water.

(c) Permanent Water Table. The permanent water table is 30 to 32 feet below the ground surface at approximate elevation 202. The permanent water table was sampled in auger hole 5 and in monitoring well 154, an upgradient well for the site. Two downgradient monitoring wells were screened in the permanent water table, however they were reading a much higher water level, indicating their seals were defective. Therefore, there is no data other than that from hole 5 with which to analyze the quality of the permanent water table. Soil samples from hole 5 at the depth of the permanent water table are contaminated with lead and barium; however a water sample from that depth had only lead at a concentration of .07 mg/l, barely above the water quality standard. There appears to be localized contamination in the permanent water table, but it is believed to be the result of piping of contaminants down poorly-sealed monitoring wells, and not due to migration of contaminants through the clay-shale. Data from the new wells (197 and 198) will be helpful in assessing the quality of the groundwater and effectiveness of the closure of the site. All laboratory results are presented in Appendix I.

IV - CLOSURE PLAN

4-01. General. Geotechnical investigations show that a low-permeabililty clay-shale layer exists beneath the site area which would be suitable for use as a lower boundary in an on-site closure cell scheme. Furthermore, excavation and disposal of contaminated materials in the hazardous waste landfill is too costly (See Sections 5 and 6). Therefore, the proposed plan for closure of Site 27 is to utilize slurry walls and a compacted low-permeability soil cap to close the heavy metal contaminated materials and soil in place. The pond sediments, contaminated with several priority pollutant organic compounds, would be solidified and disposed of in the hazardous waste landfill. Closure of this site would be accomplished as follows.

4-02 Closure plan. (See also drawing 5.)

(a) Pond dewatering. Prior to commencement of any earthwork or contaminated material handling, the pond would be dewatered. Dewatering of the pond would be accomplished by pumping the water to natural overland drainage away from the site.

(b) Pond sediment disposal. The in-situ soils surrounding the pond have been effectively preventing the migration of the priority pollutant organic compounds found in the pond sediments. However, to eliminate potential degradation in permeability to the surrounding soils and slurry wall which could arise through long term contact with these organic compounds, these sediments would be removed and disposed into the hazardous waste landfill. Since these sediments currently exist in a viscous state they would be mixed, upon excavation, with flyash reducing their moisture content to an acceptable level allowing placement into the landfill. It is anticipated that a mixture ratio of 1 part sediments to 4 parts flyash would achieve this goal. About 250 cubic yards of sediments would require solidification, thus approximately 1250 cubic yards of solidified sediments would be hauled to the hazardous waste landfill. Laboratory testing would be performed during final design to verify the mixture ratio necessary to obtain the required moisture content for landfill disposal. It should be noted that the disturbance and handling of these sediments to accomplish landfill disposal would classify this portion of the contaminants at Site 27 as a RCRA hazardous waste. A temporary washrack facility would be constructed at the site to allow washdown of hauling vehicles prior to their leaving the site area. Construction equipment would also be washed prior to handling clean fill/earth, and prior to transportation off-site. Washwater would be collected in a holding tank and transported to the Arsenal's industrial waste treatment facility, via tanker or industrial sewer system, for treatment.

(c) Closure preparation. The following items would then be accomplished prior to installation of the slurry wall. The site would be cleared and all existing structural debris placed into the pond. (Structural debris includes existing fencing, the flume from Building 32-570 to the pond, and existing structural debris from abandoned mixing and filtering operations which still remain on site.) All contaminated soils

located outside the proposed slurry wall alignment and from drainage paths leading off-site would then be excavated and placed into the cell. Existing pipelines would be excavated where they intersect the slurry wall and placed into the cell. The remaining pipelines would be capped and abandoned in place. The proposed alignment would then be graded to a maximum slope of 2 percent to provide a working platform to construct the slurry wall.

(d) Slurry wall. Upon completion of placing contaminated materials into the pond, the slurry wall would be installed along the proposed alignment as shown on drawing 5. The wall would be a 30-inch thick soil-bentonite mixture keyed a minimum of 2 feet into the underlying Jackson-Group clay-shale layer, which is located approximately 18 feet beneath the site. A permeability of $1x10^{-7}$ cm/sec can be achieved through this type of slurry wall, with the final design for closure of this site addressing mix design required to achieve this permeability. Mix designs would be performed using materials from required wall excavations. All permeability testing would be performed using groundwater from the site in an effort to simulate existing natural leaching conditions.

(e) Closure completion. After completion of the slurry wall a 2-foot thick compacted low-permeability soil layer would be placed over the area enclosed by the slurry wall, and be keyed into this slurry wall. The cover would be graded to allow rapid drainage away from the cell. The remainder of the site would be graded to divert all drainage around the cell. The cell cap, and all areas disturbed during closure, would receive 6 inches of topsoil and be tilled, fertilized and seeded. The cell cover soils and drainage swale slopes would have an anchored layer of erosion control fabric installed to prevent erosion until vegetative growth can firmly establish itself. A 4-strand barbed wire fence with warning signs would be erected around the closure site to identify the site and protect it from unauthorized excavations. The proposed closure plan would encapsulate about 10,000 cubic yards of contaminated materials and structural debris. Most of this material (approximately 6,600 cubic yards) would be closed undisturbed since it is located within the proposed limits of the slurry trench. The remaining material (approximately 3,400 cubic yards) extends over a larger adjacent area and would require excavation and disposal within the slurry trench alignment in order to provide a cost effective closure cell configuration. The above quantities do not include the solidified sediments (1250 cubic yards, see para. 4b) which would be hauled to the hazardous waste landfill for disposal.

(f) Post closure operations and maintenance. The site would remain closed indefinitely. Initially, about 2 years of maintenance would be required to prevent erosion until vegetative growth is established. Periodic inspections would be held thereafter to insure against erosion development. Mowing of vegetation would be conducted a minimum of twice yearly to maintain this vegetation, and insure against trees and/or bush growth on cover soils. Existing groundwater monitoring wells would be sampled and tested every 6 months throughout the post closure period.

V - ALTERNATIVE CLOSURE PLAN

5-01. General. One alternative closure plan was considered for closure of Site 27. This plan consisted of excavation and disposal of all contaminated materials and soils from the site at the hazardous waste landfill.

5-02. Landfill Disposal. This plan would call for all contaminated materials and soils at the site to be excavated and hauled to the hazardous waste landfill. (The pond sediments would be treated as described in Section 4.) As excavations required to remove these materials and soils would result in a sizable ponding area, a substantial amount of fill would be required to backfill the excavated area to allow rapid and positive drainage out of the area. All areas disturbed by closure would then be revegetated. The quantity of materials to be disposed would necessitate enlarging the present landfill capacity to accommodate this volume of material. This plan was eliminated from further consideration for economic reasons when compared to the proposed closure plan (see Section 6).

VI - COSTS

6-01. General. Unit prices are based on average bid prices for similar type projects constructed or under construction in the Tulsa District and adjusted to October 1986 price levels. Costs for the proposed plan and for the alternative plan are shown in table 6-1.

a. Borrow availability. It was assumed that all low-permeability fill and topsoil would be supplied from an approved borrow source located on arsenal property and a 10-mile haul distance was assumed for unit cost purposes. Detailed borrow area investigations would be conducted during the final design to confirm the availability of low-permeability fill and top soil in sufficient quantities within a 10-mile haul distance.

b. Alternative closure plan. A 6-mile one-way haul distance from Site 27 to the landfill was used for contaminated material movement unit costs.

TABLE 6-1

COST ESTIMATE
(October 1986 Price Levels)

ITEM	PROPOSED CLOSURE PLAN	ALTERNATIVE CLOSURE PLAN
	$	$
Site Preparation	13,351	13,351
Sediment Treatment and Disposal	69,282	69,282
Slurry Wall Construction	76,354	--
Closure Earthwork	81,767	181,388
Contaminated Material Movement	30,022	245,372
Site Grading and Revegetation	58,420	50,842
Subtotal	329,196	560,235
Contingencies @ 5%+	16,460	28,012
Subtotal	345,656	588,247
Supervision and Inspection @ 5.5%+	19,011	32,354
TOTAL	364,667	620,601

EXHIBIT

EXHIBIT A
SITE PHOTOGRAPHS

Photograph No. 1

View, looking to the north, of the BZ Pond

APPENDICES

APPENDIX I
LABORATORY, CHEMISTRY, AND SOIL REPORTS

SWD LABORATORY REPORT 13741

SWDED-GL Report 13741

Table 1

Pine Bluff Arsenal
Site 27

Results of Chemical Analysis of Water(1)

SWD Lab No	Site Hole	Field No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	pH
G-5478	27-5	WS-1	Unknown	<0.01	<0.001	7.1	0.005	0.01	<0.0001	0.04	<0.004	0.20	7.1
5357		WS-2		<0.01	0.006	~~<0.20~~ <0.50	0.04	<0.01	0.0002	0.07	<0.004	0.08	7.2
5479	27-8	WS-1	(Stream)			~~<.39~~ <0.50				0.03		2.1	
5480	27-9	WS-1	(Stream)			~~<.31~~ <0.50				<0.01		0.04	
5481	27-10	WS-1	(Stream)			.37				0.02		0.16	
5358	27-?	W-1	Unknown	<0.01	<0.001	9.64	0.02	<0.01	<0.0001	0.01	<0.004	0.17	7.3
Minimum Reported Concentration				0.01	0.001	0.5	0.002	0.01	0.0001	0.01	0.004	0.01	

(1) Results reported in mg/l.

SWD LABORATORY REPORT 13741-1

SWDED-GL Report 13741-1

Table 1

...me Bluff Arsenal
Site 27

Results of Chemical Analysis of Soil(1)

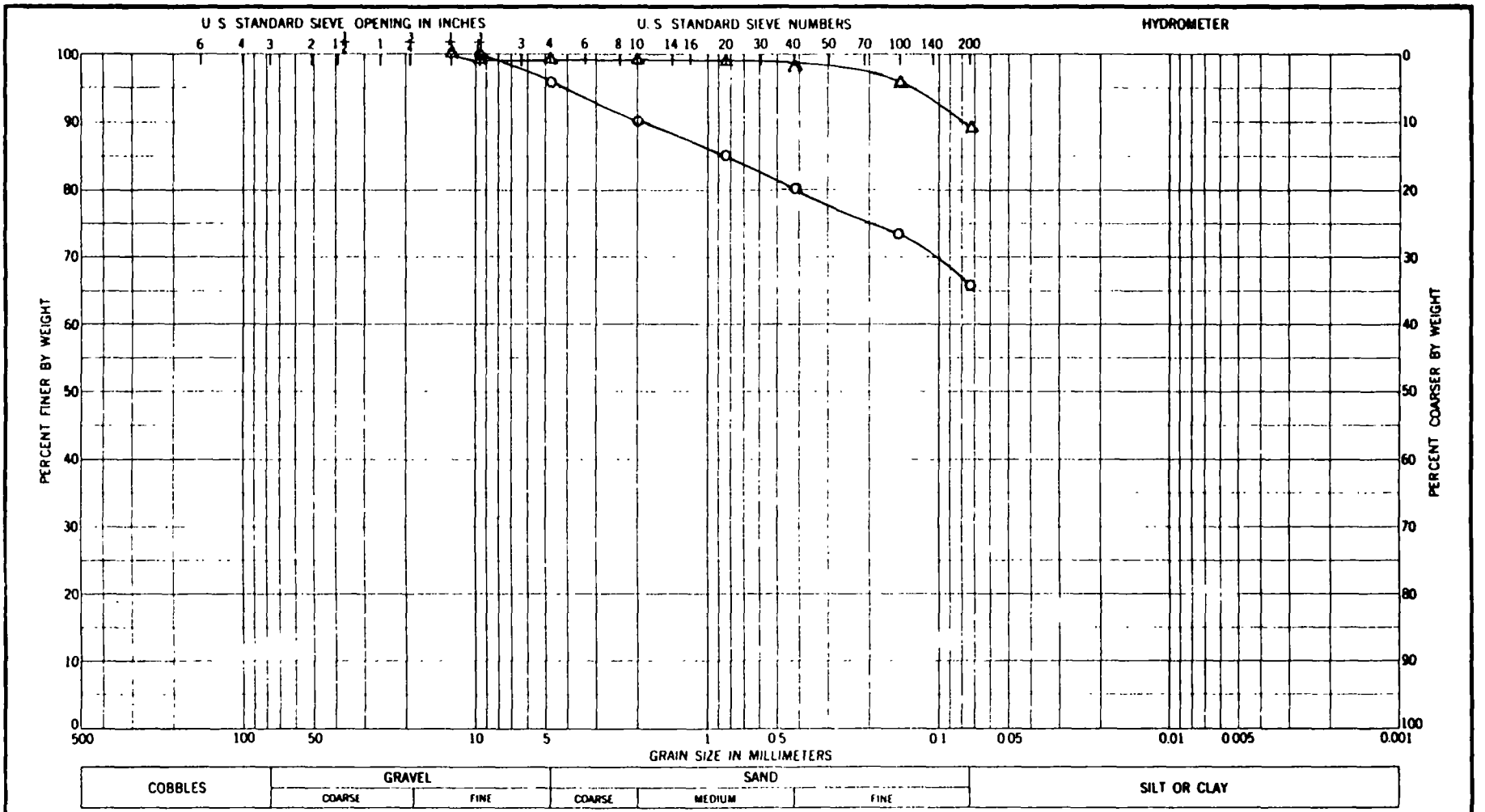
SWD Lab No	Site Hole	Field No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	pH
5297	27-1	J-1	0.0- 1.0			180				1600		190	
5299		J-3	2.0- 3.0			570				70		89	
5300		J-4	3.0- 4.0			980				300		140	
5305	27-2	J-1	0.0- 2.0			2300				1700		130	
5306		J-2	2.0- 3.0			290				65		15	
5311	27-3	J-1	0.0- 0.5			620				200		45	
5312		J-2	0.5- 3.0			970				50		20	
5316	27-4	J-1	0.0- 0.5			6500				270		180	
5317		J-2	0.5- 1.0			5500				180		230	
5321	27-5	J-1	0.0- 1.0	2.0	1.6	270	9.8	14	<0.1	10000	<0.1	450	
5322		J-2	1.0- 2.0			980				7700		320	
5323		J-3	2.0- 3.0			3700				1100		400	
5324		J-4	3.0- 4.0			2300				1400		300	
5326		J-6	5.0- 6.0			840				34		18	
5328		J-8	9.0-12.0			160				7.2		2.0	
5330		J-10	15.0-18.0			20				7.0		4.0	
5332		J-12	21.0-23.0			66				13		8.5	
5334		J-14	24.0-25.0			34				9.3		7.7	
5336		J-16	27.0-30.0			24				5.0		7.0	
5338		J-18	36.0-40.0			2200				520		140	
5339	27-6	J-1	0.0- 2.0			82				12		7.9	
5340		J-2	2.0- 4.0			57				5.2		5.6	
5344	27-7	J-1	0.0- 1.0			250				15		15	
5345		J-2	1.0- 3.0			70				6.9		4.2	
5346		J-3	3.0- 5.0			770				4.6		2.4	
5347	27-8	J-1	0.0- 1.0			1700				250		73	
5348		J-2	1.0- 3.0			840				790		9.4	
5349		J-3	3.0- 5.0			580				14		2.6	
5350	27-9	J-1	0.1- 1.0			3500				1500		1100	
5351		J-2	1.0- 3.0			1800				50		54	
5353	27-10	J-1	0.0- 1.0			1900				20		40	
5354		J-2	1.0- 3.0			410				5.5		44	
5356	27-X	GS-1	0.0- 1.0			150				31		20	
Minimum reported concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0	

(1) Results reported in mg/kg.

SWD LABORATORY REPORT 13741-2

Results of Tests of Disturbed Soil Samples

Boring No.	Field No.	SWD No.	Depth ft.	Mechanical Analysis Gr	Sa	Fi	Atterberg Limits LL	PL	PI	LS	Water Content %		Description
27-1	J-6	G-5302	5.0- 6.0	4	30	66	23	20	3		24.9	ML	SILT, sandy, gray, very moist to wet.
	J-8	5304	8.0-10.0	1	10	89	22	18	4		20.1	ML-CL	SILT, gray, very moist.
27-2	J-2	5306	2.0- 3.0	2	18	80	23	17	6		14.7	CL-ML	CLAY, sandy, gray, damp.
	J-4	5308	4.0- 6.0	0	11	89	22	18	4		19.9	ML-CL	SILT, sandy, gray, moist.
27-3	J-2	5312	0.5- 3.0	10	20	70	22	17	5		15.3	ML-CL	SILT, sandy, gray, moist.
	J-3	5313	3.0- 5.0	0	19	81	24	17	7		18.7	CL-ML	CLAY, gray, moist.
	J-4	5314	5.0- 8.0	0	45	55	22	16	6		18.1	CL-ML	sandy, gray, moist.
27-4	J-3	5318	1.0- 3.5								-	ML-CL	SILT, gray, moist.
	J-4	5319	3.5- 6.5								-	CL	CLAY, sandy, gray, moist.
27-5	J-1	5321	0.0- 1.0	26	54	20	22	20	2		20.8	SM	SAND, clayey, gravelly, dark red brown, moist.
	J-2	5322	1.0- 2.0	28	57	15	23	13	10		10.8	SC	SAND, clayey, gravelly, dark red brown, moist.
	J-5	5325	4.0- 6.0	1	25	74	22	16	6		20.0	CL-ML	CLAY, sandy, gray, moist.
	J-7	5327	6.0- 9.0	0	69	31	NP	NP	NP	0	20.8	SM	SAND, silty, gray, moist.
	J-10	5330	15.0-18.0	1	64	35	16	13	3		18.9	SM	SAND, silty, gray, very moist.
	J-11	5331	18.0-21.0	0	9	91	47	16	31		24.1	CL	CLAY, gray, moist.
27-6	J-3	5341	4.0- 6.0	1	24	75	21	17	4		19.8	ML-CL	SILT, sandy, gray, moist.



Sample No.	Elev or Depth	* Classification	Nat w %	LL	PL	PI
C-5302 ○	5.0-6.0	SILT, sandy (ML)	24.9	23	20	3
C-5304 △	8.0-10.0	SILT, (ML-CL)	20.1	22	18	4

Project Pine Bluff Arsenal

Area

Boring No. 27-1

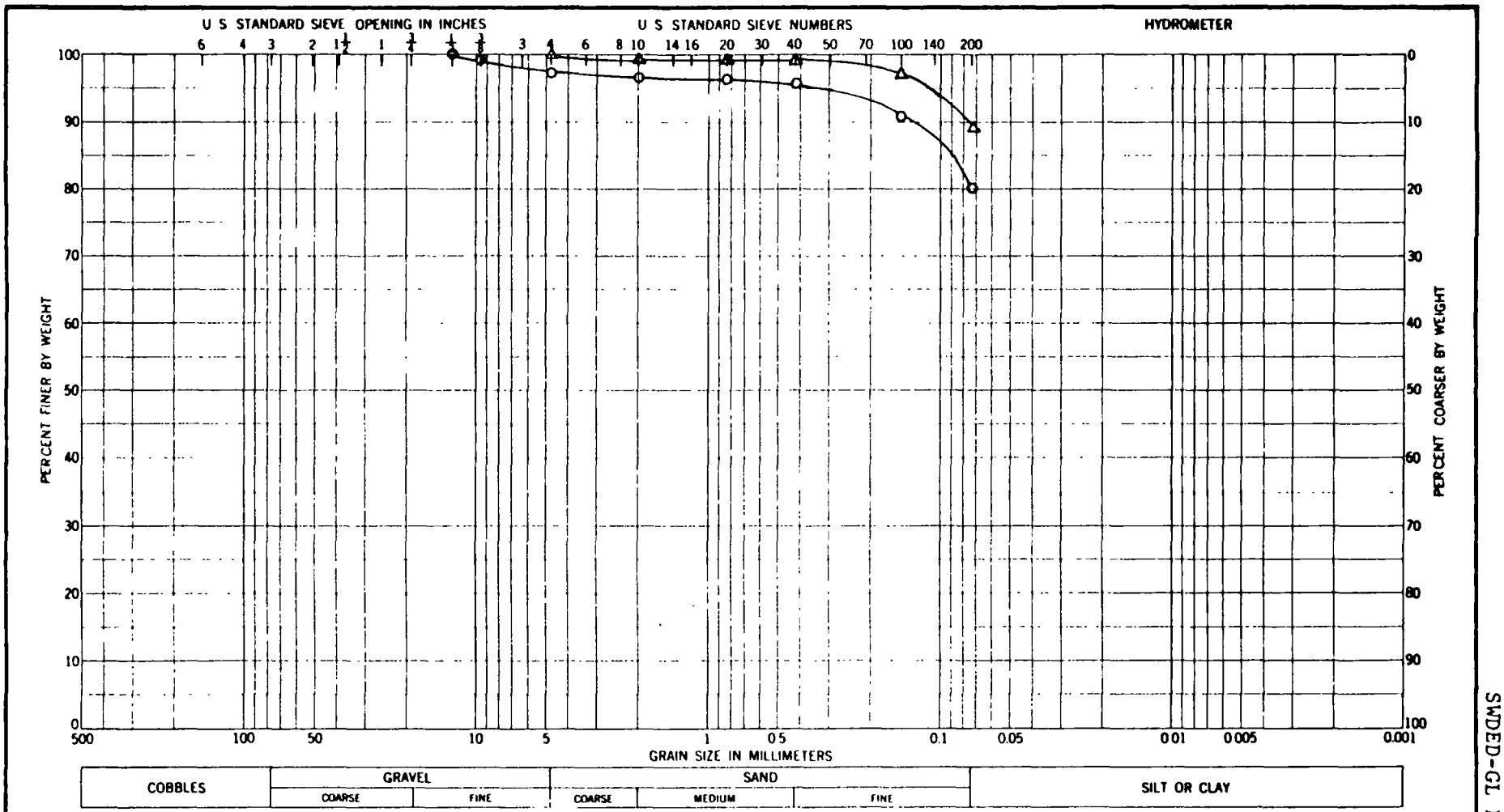
Date April 84

GRADATION CURVES

Plate 1

ENG FORM 1 MAY 63 2087

SWDED-GL Report No. 13741-2



Sample No	Elev or Depth	• Classification	Nat w %	LL	PL	PI
G-5306 ○	2.0-3.0	CLAY, sandy (CL-ML)	14.7	23	17	6
G-5308 △	4.0-6.0	SILT, (ML-CL)	19.9	22	18	4

Project: Pine Bluff Arsenal

Area:

Boring No: 27-2

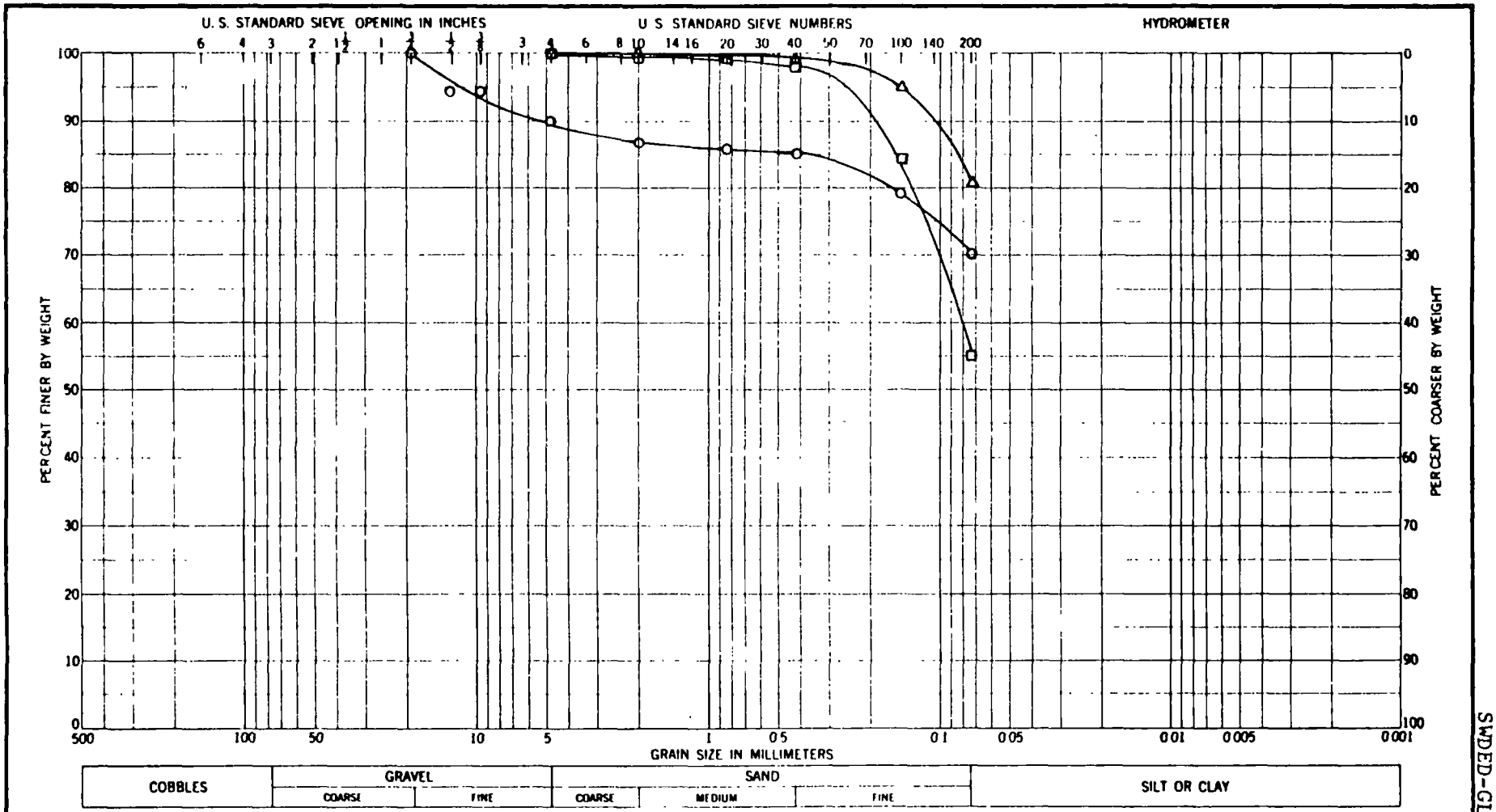
Date: April 84

GRADATION CURVES

Plate 2

ENG FORM 1 MAY 63 2087

SWDED-GI Report No. 13741-2



Sample No	Elev or Depth	* Classification	Nat w %	LL	PL	PI
G-5312 ○	0.5-3.0	SILT, sandy (ML-CL)	15.3	22	17	5
G-5313 △	3.0-5.0	CLAY, (CL-ML)	18.7	24	17	7
G-5314 □	5.0-8.0	CLAY, sandy (CL-ML)	18.1	22	16	6

GRADATION CURVES

Project Pine Bluff Arsenal

Area

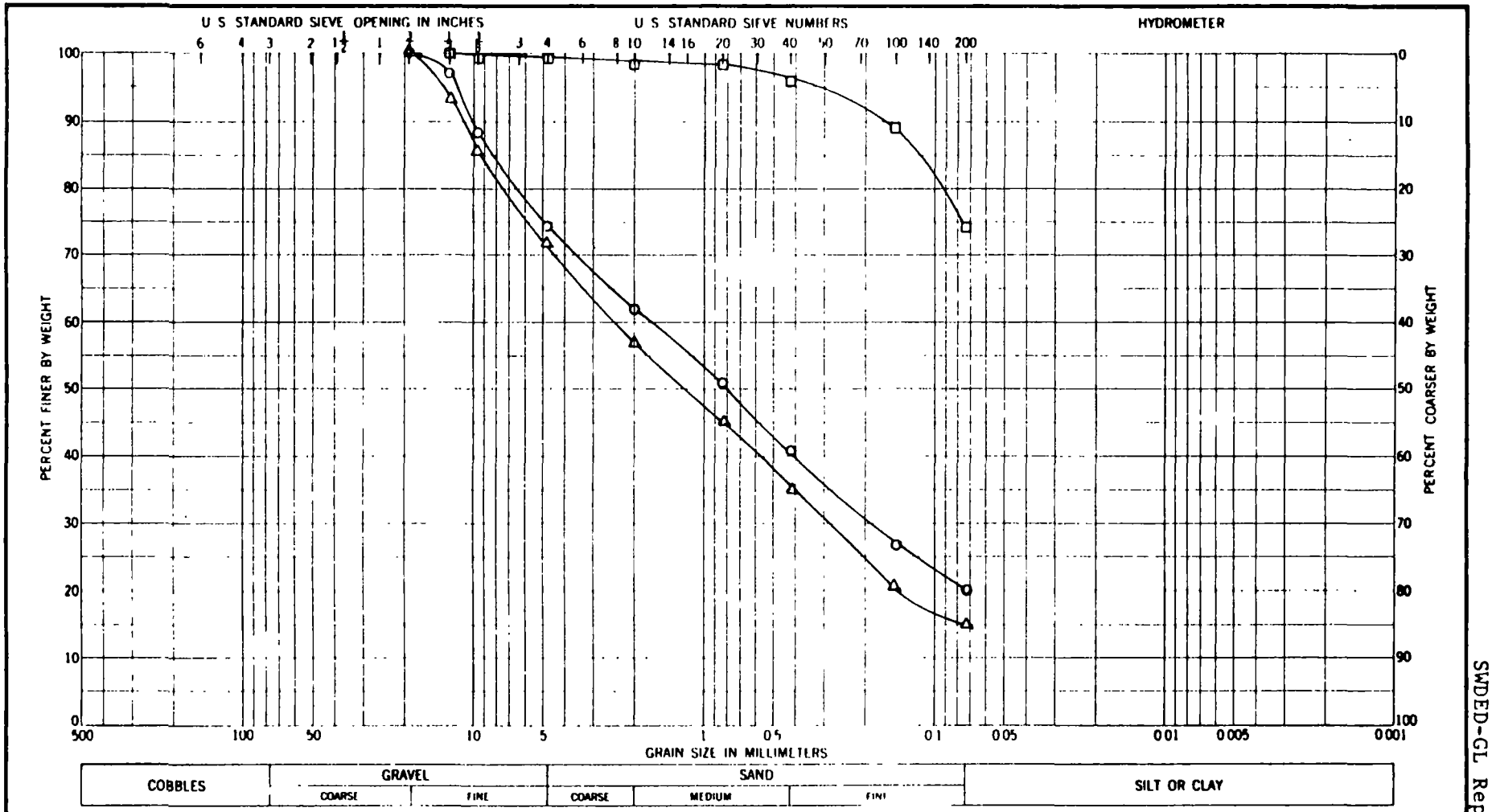
Boring No. 27-3

Date April 84

SWDED-GL Report No. 13741-2

Plate 3

ENG FORM 1 MAY 63 2087



Sample No	Elev or Depth	* Classification	Nat w %	LL	PL	PI
G-5321 ○	0.0-1.0	SAND, silty, gravelly (SM)	20.8	22	20	2
G-5322 △	1.0-2.0	SAND, clayey, gravelly(SC)	10.8	23	13	10
G-5325 □	4.0-6.0	CLAY, sandy (CL-ML)	20.0	22	16	6

GRADATION CURVES

Project: Pine Bluff Arsenal

Area:

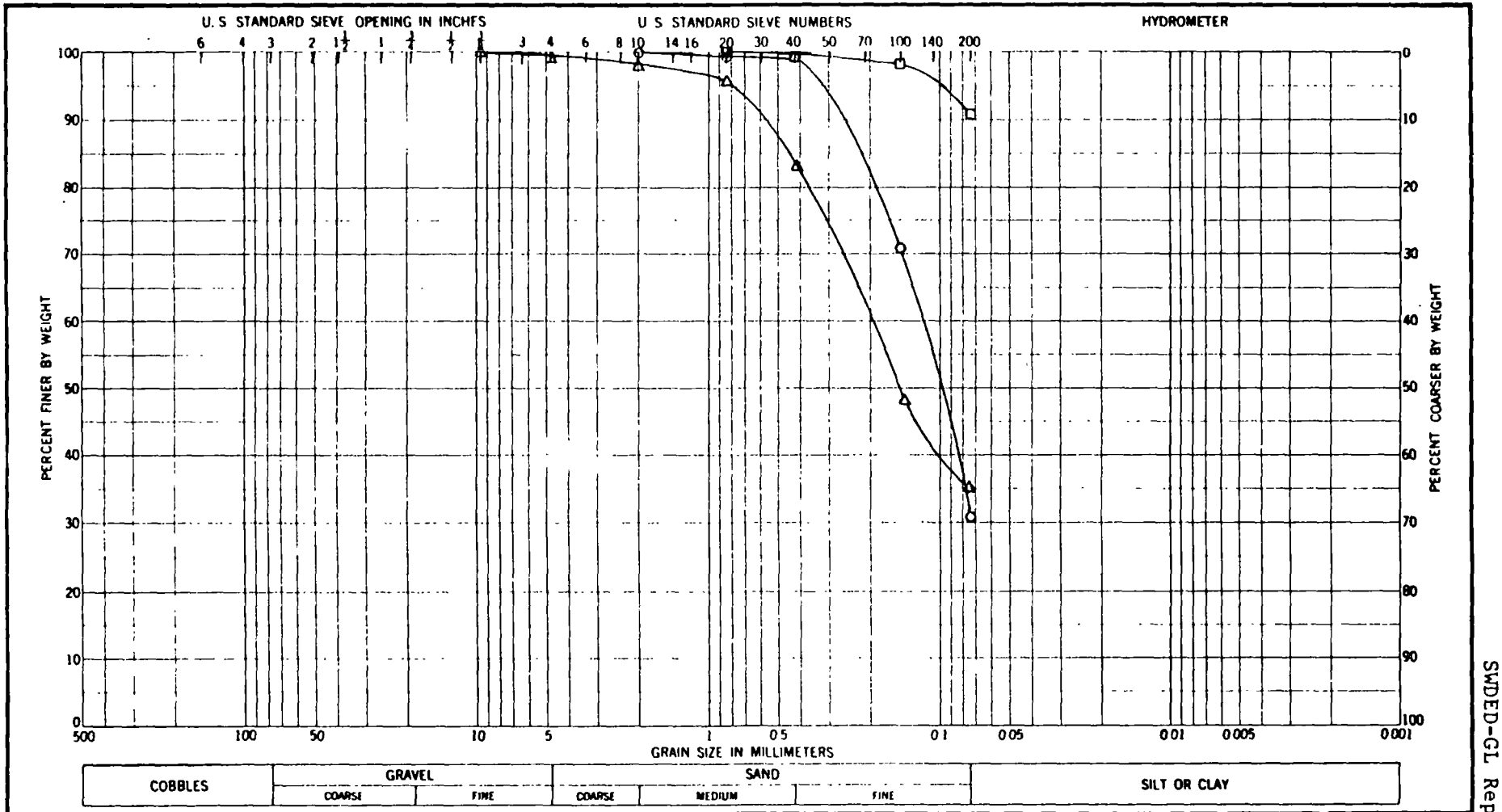
Boring No.: 27-5

Date: April 84

SWDED-GL Report No. 13741-2

Plate 4

ENG FORM 1 MAY 63 2087



Sample No	Elev or Depth	• Classification	Nat w %	LL	PL	PI
G-5327 ○	6.0-9.0	SAND, silty (SM)	20.8	NP	NP	NP
G-5330 △	15.0-18.0	SAND, silty (SM)	18.9	16	13	3
G-5331 □	18.0-21.0	CLAY (CL)	24.1	47	16	31

GRADATION CURVES

Project: Pine Bluff Arsenal

Area:

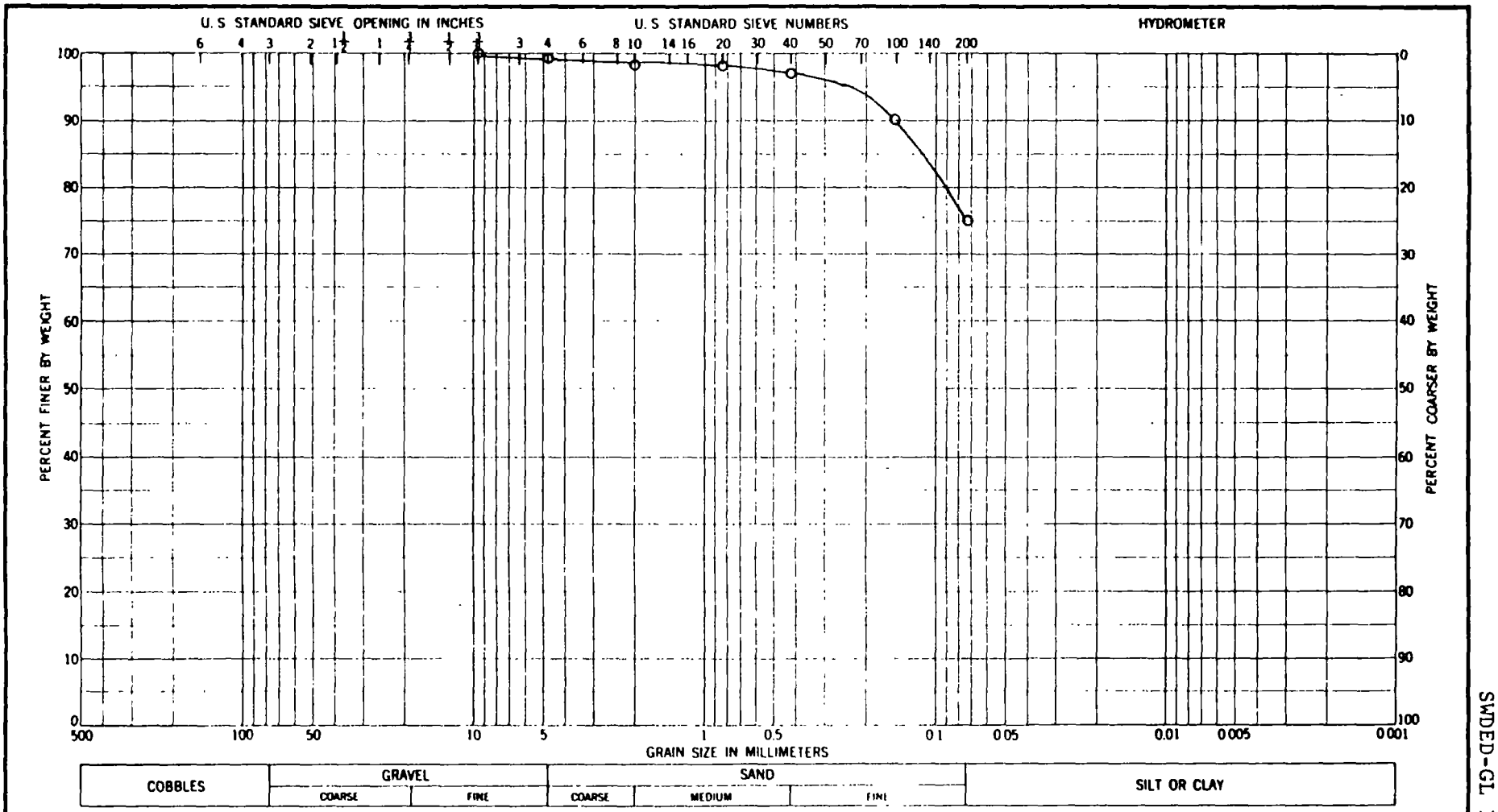
Boring No.: 27-5

Date: April 84

SWDED-GL Report No. 13741-2

Plate 5

ENG FORM 1 MAY 63 2087



Sample No.	Elev or Depth	• Classification	Nat w %	LL	PL	PI
G-5341	4.0-6.0	SILT, sandy (ML-CL)	19.8	21	17	4

Project: Pine Bluff Arsenal

Area:

Boring No: 27-6

Date: April 84

GRADATION CURVES

Plate 6

ENG FORM 1 MAY 63 2087

SWDED-GL Report No. 13741-2

SWD LABORATORY REPORT 13741-3

Results of Chemical Analysis of Soil(1)

SWD Lab No	Site Hole	Jar No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	Ca
5301	27-1	J-5	4.0- 5.0			2000				100			
5302		J-6	5.0- 6.0			2900				125			
5303		J-7	6.0- 8.0			55				15			
5304		J-8	8.0-10.0			120				11			
5305	27-2	J-1	0.0- 2.0										39
5307		J-3	3.0- 4.0			180				21			
5308		J-4	4.0- 6.0			32				9.1			
5309		J-5	6.0- 8.0			54				11			
5310		J-6	8.0-10.0			39				10			
5313	27-3	J-3	3.0- 5.0			32				12			
5314		J-4	5.0- 8.0			55				7.3			
5315		J-5	8.0-10.0			400				5.0			
5316	27-4	J-1	0.0- 0.5										7.6
5317		J-2	0.5- 1.0										39
5318		J-3	1.0- 3.5			30				11			
5319		J-4	3.5- 6.5			110				9.7			
5320		J-5	6.5- 8.5			64				10			
5320B		J-6	8.5-10.0			78				10			
5359	27-SD-1	J-1	Unknown	<0.5	<1.0	310	1.6	49	<0.1	430	<0.1	5300	
Minimum reported concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0	

(1) Results reported in mg/kg.

SWD LABORATORY REPORT 13741-4

SWDED-GL Report 13741-4

Table 1

Pine Bluff Arsenal
Site 27

Results of Chemical Analysis of Soil for EP Toxicity (1)

SWD Lab No	Site Hole	Field No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn
5321	27-5	J-1	0.0-1.0	<0.01	0.14	<0.50	0.05	<0.01	<0.0001	0.21	<0.0004	
Minimum Reported Concentration				0.01	0.001	0.50	0.002	0.01	0.0001	0.01	0.0004	
EP Toxicity Limits				5.0	5.0	100.0	1.0	5.0	0.2	5.0	1.0	

(1) Results reported in mg/l

SWD LABORATORY REPORT 13741-5

SWDED-GL Report 13741-5

Table 1

Pine Bluff Arsenal
Site 27

Results of Chemical Analysis of Soils(1)

SWD Lab No	Site Hole	Field No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn
6573	27-13	1	0.0-1.0			69				12		5.2
6574		2	1.0-2.0			46				13		5.6
6575		3	2.0-3.0			150				9.5		6.2
6576		4	3.0-6.5			< ~~17~~ 20				6.4		6.2
6577		5	6.5-10.0			< ~~17~~ 20				2.7		2.2
6578	27-14	1	0.0-1.0			32				9.0		3.5
6579		2	1.0-2.0			20				2.0		3.5
6539	27-17	1	0.0-1.0			23				11		7.8
6540		2	1.0-2.0			22				11		5.4
6543	27-18	1	0.0-0.7			310				33		25
6544		2	0.7-1.7			89				76		8.9
6547	27-19	1	0.1-1.0			290				150		38
6548		2	1.0-2.0			350				31		7.6
6552	27-20	1	0.0-1.1			400				81		31
6553		2	1.1-2.1			< ~~5.6~~ 20				14		8.0
Minimum reported concentration						20.0				1.0		1.0

(1) Results reported in mg/kg

Table 2

Results of Chemical Analysis of Water (1)

SWD Lab No	Site Hole	Field No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn
6551	27-19	WS-1	WT. 2.9-5.0			< 0.5				0.04		0.07
Minimum reported concentration						0.5				0.01		0.01

(1) Results reported in mg/l

SWD LABORATORY REPORT 13741-6

Results of Tests of Disturbed Soil Samples

Boring No.	Field No.	SWD No.	Depth ft.	Mechanical Analysis Gr	Sa	Fi	Atterberg Limits LL	PL	PI	LS	Water Content %	Description	
27-197	J-3	G-6711	31.0-34.0	0	93	7	NP	NP	NP	0	20.8	SP-SM	SAND, yellow brown, very moist.
	J-5	6713	37.0-40.0	0	87	13	NP	NP	NP	0	25.0	SM	SAND, silty, yellow brown, wet.
	J-7	6715	43.0-44.8	0	91	9	NP	NP	NP	0	18.8	SP-SM	SAND, yellow brown, very moist.
27-198	J-1	6596	0.0- 3.0	0	12	88	21	19	2		16.6	ML	SILT, gray brown, moist.
	J-2	6597	3.0- 5.0	0	6	94	43	16	27		20.9	CL	CLAY, gray brown, moist.
	J-3	6598	5.0- 8.0	0	8	92	34	15	19		20.2	CL	CLAY, yellow brown, moist.
	J-6	6601	13.0-16.3	0	88	12	NP	NP	NP	0	15.0	SM-SP	SAND, silty, gray brown, very moist.
	J-7	6602	16.3-19.0	0	25	75	34	12	22		19.4	CL	CLAY, sandy, gray, moist.

SWD LABORATORY REPORT 13741-7

Table 1

Results of Chemical Analysis of Soil[1]

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn
27-11	Jar 1	6897	0.0- 1.0			210				13		6.8
	2	6898	1.0- 2.0			200				14		8.7
	3	6899	2.0- 3.0			55				9.7		5.7
27-12	1	6902	0.0- 1.0			210				9.8		8.5
	2	6903	1.0- 2.0			73				9.6		8.2
	3	6904	2.0- 3.0			38				9.3		7.4
	4	6905	3.0- 6.5			26				8.9		6.3
27-15	1	6583	0.0- 1.0			220				9.6		
	2	6584	1.0- 2.0			360				11		
27-16	1	6587	0.0- 1.0			380				19		
	2	6588	1.0- 2.0			84				12		
27-18	3	6545	1.7- 2.7			210				19		
	4		2.7- 5.0			490				45		
27-19	3	6549	2.0- 2.7			150				6.6		
	4	6550	2.7- 5.0			62				8.5		
27-20	3	6554	2.1- 3.1			23				6.3		
	4	6555	3.1- 7.0			41				8.7		
27-21	1	6592	0.0- 1.0			460				17		
	2	6593	1.0- 2.0			180				11		
	3	6594	2.0- 3.0			<20				8.2		
	4	6595	3.0- 5.0			36				7.0		
27-23	1	6907	0.0- 1.0			6500				79		470
	2	6908	0.0- 1.0			420				11		20
27-24	1	6909	0.0- 1.0			440				12		22
	2	6910	1.0- 2.0			38				7.9		3.8
27-197	3	6711	31.0-34.0			<20				2.3		
	5	6713	37.0-40.0			<20				2.8		
	7	6715	43.0-44.8			<20				3.3		
Minimum reported concentration				**0.5**	**1.0**	**20.0**	**0.5**	**5.0**	**0.1**	**1.0**	**0.1**	**1.0**

(1) Results reported in mg/kg

Table 1 (Cont'd)

Results of Chemical Analysis of Soil[1]

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	
27-198	Jar 1	6596	0.0- 3.0			< 20				12			
	2	6597	3.0- 5.0			23				13			
	3	6598	5.0- 8.0			53				10			
	6	6601	13.0-16.3			< 20				2.6			
	7	6602	16.3-19.0			< 20				6.9			
Minimum reported concentration				**0.5**	**1.0**	**20.0**	**0.5**	**5.0**	**0.1**	**1.0**	**0.1**	**1.0**	

(1) Results reported in mg/kg

SWD LABORATORY REPORT 13741-8

Results of Chemical Analysis of Soil[1]

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn
27-22	Jar 1	6962	0.0- 3.0	< 0.5	1.4	30	< 0.5	< 5.0	< 0.1	8.9	0.5	3.8
	Jar 3	6964	6.0- 9.0	< 0.5	< 1.0	35	< 0.5	< 5.0	< 0.1	7.1	< 0.1	5.2
	Jar 5	6966	12.0-15.0	< 0.5	< 1.0	< 20	< 0.5	< 5.0	< 0.1	1.5	< 0.1	2.0
	Jar 7	6968	18.0-21.0	< 0.5	< 1.0	46	< 0.5	< 5.0	< 0.1	5.1	< 0.1	5.9
	Jar 9	6970	24.0-26.5	< 0.5	< 1.0	27	< 0.5	< 5.0	< 0.1	6.4	< 0.1	7.6
27-23	Jar 3	6975	2.0- 3.5			86				13		14
	Jar 4	6976	3.5- 6.5			78				6.5		6.5
Minimum reported concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0

(1) Results reported in mg/kg

SWD LABORATORY REPORT 13741-9

Results of Chemical Analysis of Soil[1]

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn
27-25	J-1	7173	1.35-1.95			5500	6.5	210		650		20000
	J-2	7174	1.95-2.3			2200	3.1	53		4300		3400
27-26	J-1	7175	8.6 -8.9	0.9	51	1200	1.9	270	<0.1	1000	11	28000
	J-2	7176	8.9 -9.2	1.0	14	410	7.3	2000	1.2	5700	<0.1	730
27-27	J-1	7177	9.05-9.3			140	5.7	1400		5200		290
	J-2	7178	9.3 -9.7			3500	10	1200		2200		12
Minimum reported concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0

(1) Results reported in mg/kg

Table 2

Pine Bluff Arsenal
Site 27

Results of Chemical Analysis of Water(1)

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	
27-26	WS-1	7179	Unknown			4.46	0.008	<0.01		0.07		0.04	
Minimum Reported Concentration				0.01	0.001	0.50	0.002	0.01	0.0001	0.01	0.0004	0.01	

(1) Results reported in mg/l.

SWD LABORATORY REPORT 13741-10

ALLIED ANALYTICAL & RESEARCH LABORATORIES
3031 Glenfield
P.O. Box 24330
Dallas, Texas 75224
Chemists
Consultants & Technologists
214/337-8998

August 9, 1984

SAMPLE Water & Sludge

DATE SUBMITTED 7/20/84

IDENTIFYING MARKS See Below

ANALYTICAL REPORT NO. 63156

SUBMITTED BY
U S Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas, Texas 75235-8011

ANALYSIS

Sample ID: 27-26 WS-2
Purgeables

COMPOUND	MDL,ppb	CONC,ppb
Chloromethane	10	NA
Bromomethane	10	NA
Vinyl Chloride	10	NA
Chloroethane	10	NA
Methylene Chloride	3	NA
Trichlorofluoromethane	10	NA
1, 1 Dichloroethylene	3	NA
1, 1 Dichloroethane	5	NA
trans-1, 2-Dichloroethylene	2	NA
Chloroform	2	NA
1, 2 Dichloroethane	3	NA
1, 1, 1 Trichloroethane	4	22
Carbon Tetrachloride	3	NA
Bromodichloromethane	2	NA
1, 2 Dichloropropane	6	NA

NA = Below Minimum Detectable Level (MDL)

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ALLIED ANALYTICAL & RESEARCH LABORATORIES
3031 Glenfield
P.O. Box 24330
Dallas, Texas 75224
Chemists
Consultants & Technologists
214/337-8996

August 9, 1984

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SUBMITTED BY
U S Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas, Texas 75235-8011

ANALYSIS

Sample ID: 27-26 WS-2

Purgeables

COMPOUND	MDL,ppb	CONC.,ppb
trans-1, 3-Dichloropropylene	5	NA
Trichloroethylene	2	NA
Dibromochloromethane	3	NA
cis-1, 3-Dichloropropylene	10	NA
1, 1, 2-Trichloroethane	5	NA
Benzene	4	NA
2-Chloroethylvinylether	10	NA
Bromoform	5	NA
Tetrachloroethylene	4	NA
1, 1, 2, 2 Tetrachloroethane	7	NA
Toluene	6	31
Chlorobenzene	6	NA
Ethyl Benzene	7	112
Acrolein	50	NA
Acrylonitrile	50	NA

NA = Below Minimum Detectable Level (MDL)

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SUBMITTED BY
U S Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas, Texas 75235-8011

ANALYSIS

Sample ID: 27-~~27~~ 26 WS-2
Base-Neutral Extractables

COMPOUND	MDL,ppb	CONC.,ppb
1, 3 Dichlorobenzene	2	NA
1, 4 Dichlorobenzene	4	NA
Hexachloroethane	2	NA
1, 2 Dichlorobenzene	2	NA
Bis (2-chloroisopropyl) ether	6	NA
Hexachlorobutadiene	1	NA
1, 2, 4 Trichlorobenzene	2	NA
Naphthalene	2	NA
Bis (2-chloroethyl) ether	6	NA
Hexachlorocyclopentadiene	50	NA
Nitrobenzene	2	NA
Bis (2-chloroethoxy) Methane	5	NA
2-Chloronaphthalene	2	NA
Acenaphthylene	4	NA
Acenaphthene	2	NA

NA = Below Minimum Detectable Level (MDL)

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Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas, Texas 75235-8011

ANALYSIS

Sample ID: 27-~~27~~ 26 WS-2
Base-Neutral Extractables

COMPOUND	MDL,ppb	CONC.,ppb
Isophorone	2	NA
Fluorene	2	NA
2, 6 Dinitrotoluene	2	NA
1, 2 Diphenylhydrazine	2	NA
2, 4 Dinitrotoluene	6	NA
n-Nitrosodiphenylamine	2	NA
Hexachlorobenzene	2	NA
4-Bromophenyl Phenyl Ether	2	NA
Phenanthrene	5	NA
Antharacene	2	NA
Dimethyl Phthalate	2	NA
Diethyl Phthalate	22	NA
Fluoranthene	2	NA
Pyrene	2	NA
Di-n-butyl Phthalate	2	NA
Benzidene	44	NA
Butyl Benzyl Phthalate	3	NA

NA = Below Minimum Detectable Level (MDL)

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U S Corp of Engineers
Attn: Jeff Tye
ADDRESS 4815 Cass
Dallas, Texas 75235-8011

ANALYSIS

Sample ID: 27-~~27~~ 26 WS-2
Base-Neutral Extractables

COMPOUND	MDL,ppb	CONC.,ppb
Chrysene	3	NA
Bis (2-ethylhexyl) Phthalate	3	20
Benzo (a) anthracene	8	NA
Benzo (b) fluoranthene	5	NA
Benzo (k) fluoranthene	3	NA
Benzo (a) pyrene	3	NA
Indeno (1,2,3-cd) Pyrene	4	NA
Dibenzo (a,h) anthracene	3	NA
Benzo (g,h,i) perylene	4	NA
n-Nitrosodimethylamine	100	NA
n-Nitrosodi-n-propylamine	2	NA
4-Chlorophenyl phenyl ether	4	NA
3, 3' Dichlorobenzidine	17	NA
2, 3, 7, 8 TCDD	50	NA
Bis (chloromethyl) ether	6	NA
Di-n-octyl Phthalate	3	NA

NA = Below Minimum Detectable Level (MDL)

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August 9, 1984

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ANALYTICAL REPORT NO. 63156

SUBMITTED BY U S Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas, Texas 75235-8011

ANALYSIS

Sample ID: ~~26~~ 27-26 ~~27~~ WS-2
Acid & Pesticide Extractables

COMPOUND	MDL,ppb	CONC,ppb
2-Chlorophenol	3	NA
Phenol	2	NA
2, 4 Dichlorophenol	3	NA
2-Nitrophenol	4	NA
p-Chloro-m-Cresol	3	NA
2, 4, 6 Trichlorophenol	3	NA
2, 4 Dimethylphenol	3	NA
2, 4 Dinitrophenol	42	NA
2 methyl-4, 6 Dinitrophenol	24	NA
4-Nitrophenol	2	NA
Pentachlorophenol	4	NA
b-Endosulfan	100	NA
a-BHC	100	NA
4-BHC	100	NA
b-BHC	4	NA

NA = Below Minimum Detectable Level.(MDL)

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SUBMITTED BY
U S Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas, Texas 75235-8011

ANALYSIS

Sample ID: ~~26-27~~ 27-26 WS-2
Acid & Pesticide Extractables

COMPOUNDS	MDL,ppb	CONC,ppb
Aldrin	2	NA
Heptaclor	2	NA
Heptaclor Epoxide	2	NA
a-Endosulfan	100	NA
Dieldrin	3	NA
4, 4'-DDE	6	NA
4, 4'-DDD	3	NA
4, 4'-DDT	5	NA
Endrin	100	NA
Endrin Aldehyde	100	NA
Endosulfan Sulfate	6	NA
d-BHC	3	NA
Chlordane	1000	NA
Toxaphene	5000	NA
PCB (total)	100	NA

NA = Below Minimum Detectable Level (MDL)

H. Morris Weller, President

ALLIED ANALYTICAL & RESEARCH LABORATORIES, BY

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August 9, 1984

SAMPLE Water & Sludge

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ANALYTICAL REPORT NO. 63156

SUBMITTED BY
U S Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas, Texas 75235-8011

ANALYSIS

Sample ID: Site PBA Hole 27-26 8.6-8.9
Purgeables

COMPOUND	MDL,ppb	CONC,ppb
Chloromethane	383	NA
Bromomethane	383	NA
Vinyl Chloride	383	NA
Chloroethane	383	NA
Methylene Chloride	115	NA
Trichlorofluoromethane	383	NA
1, 1 Dichloroethylene	115	996169
1, 1 Dichloroethane	192	NA
trans-1, 2-Dichloroethylene	77	NA
Chloroform	77	133984
1, 2 Dichloroethane	115	1638
1, 1, 1 Trichloroethane	153	NA
Carbon Tetrachloride	115	3206
Bromodichloromethane	77	NA
1, 2 Dichloropropane	230	NA

NA = Below Minimum Detectable Level (MDL)

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ANALYSIS

Sample ID: Site PBA Hole 27-26 8.6-8.9
Purgeables

COMPOUND	MDL,ppb	CONC.,ppb
trans-1, 3-Dichloropropylene	192	NA
Trichloroethylene	77	4970
Dibromochloromethane	115	NA
cis-1, 3-Dichloropropylene	383	NA
1, 1, 2-Trichloroethane	192	NA
Benzene	153	NA
2-Chloroethylvinylether	383	NA
Bromoform	192	NA
Tetrachloroethylene	153	2309988
1, 1, 2, 2 Tetrachloroethane	268	NA
Toluene	230	NA
Chlorobenzene	230	NA
Ethyl Benzene	268	NA
Acrolein	1916	NA
Acrylonitrile	1916	NA

NA = Below Minimum Detectable Level (MDL)

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August 9, 1984

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IDENTIFYING MARKS See Below **ANALYTICAL REPORT NO.** 63156

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U S Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas, Texas 75235-8011

ANALYSIS

Sample ID: Site PBA Hole 27-26 8.6-8.9
Base-Neutral Extractables

COMPOUND	MDL,ppb	CONC.,ppb
1, 3 Dichlorobenzene	1116	NA
1, 4 Dichlorobenzene	2231	NA
Hexachloroethane	1116	9804
1, 2 Dichlorobenzene	1116	NA
Bis (2-chloroisopropyl) ether	3347	NA
Hexachlorobutadiene	558	NA
1, 2, 4 Trichlorobenzene	1116	NA
Naphthalene	1116	26006
Bis (2-chloroethyl) ether	3347	NA
Hexachlorocyclopentadiene	50	NA
Nitrobenzene	1116	NA
Bis (2-chloroethoxy) Methane	2789	NA
2-Chloronaphthalene	1116	NA
Acenaphthylene	2231	NA
Acenaphthene	1116	NA

NA = Below Minimum Detectable Level (MDL)

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Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas, Texas 75235-8011

ANALYSIS

Sample ID: Site PBA Hole 27-26 8.6-8.9
Base-Neutral Extractables

COMPOUND	MDL,ppb	CONC.,ppb
Isophorone	1116	NA
Fluorene	1116	NA
2, 6 Dinitrotoluene	1116	NA
1, 2 Diphenylhydrazine	1116	NA
2, 4 Dinitrotoluene	3347	NA
n-Nitrosodiphenylamine	1116	NA
Hexachlorobenzene	1116	NA
4-Bromophenyl Phenyl Ether	1116	NA
Phenanthrene	2789	NA
Antharacene	1116	NA
Dimethyl Phthalate	1116	NA
Diethyl Phthalate	10000	NA
Fluoranthene	1116	NA
Pyrene	1116	NA
Di-n-butyl Phthalate	1116	4903
Benzidene	10000	NA
Butyl Benzyl Phthalate	1673	NA

NA = Below Minimum Detectable Level (MDL)

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August 9, 1984

SAMPLE Water & Sludge

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ANALYTICAL REPORT NO. 63156

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U S Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas, Texas 75235-8011

ANALYSIS

Sample ID: Site PBA Hole 27-26 8.6-8.9
Base-Neutral Extractables

COMPOUND	MDL,ppb	CONC.,ppb
Chrysene	1673	NA
Bis (2-ethylhexyl) Phthalate	1673	14417
Benzo (a) anthracene	4462	NA
Benzo (b) fluoranthene	2789	NA
Benzo (k) fluoranthene	1673	NA
Benzo (a) pyrene	1673	NA
Indeno (1,2,3-cd) Pyrene	2231	NA
Dibenzo (a,h) anthracene	1673	NA
Benzo (g,h,i) perylene	2231	NA
n-Nitrosodimethylamine	100	NA
n-Nitrosodi-n-propylamine	1116	NA
4-Chlorophenyl phenyl ether	2231	NA
3, 3' Dichlorobenzidine	9482	NA
2, 3, 7, 8 TCDD	10000	NA
Bis (chloromethyl) ether	3347	NA
Di-n-octyl Phthalate	1673	NA

NA = Below Minimum Detectable Level (MDL)

ALLIED ANALYTICAL & RESEARCH LABORATORIES, BY_____

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Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas, Texas 75235-8011

ANALYSIS

Sample ID: Site PBA Hole 27-26 8.6-8.9
Acid & Pesticide Extractables

COMPOUNDS	MDL,ppb	CONC,ppb
Aldrin	2	NA
Heptaclor	2	NA
Heptaclor Epoxide	2	NA
a-Endosulfan	100	NA
Dieldrin	3	NA
4, 4'-DDE	6	NA
4, 4'-DDD	3	NA
4, 4'-DDT	5	NA
Endrin	100	NA
Endrin Aldehyde	100	NA
Endosulfan Sulfate	6	NA
d-BHC	3	NA
Chlordane	1000	NA
Toxaphene	5000	NA
PCB (total)	100	NA

NA = Below Minimum Detectable Level (MDL)

H. Morris Weller, President

ALLIED ANALYTICAL & RESEARCH LABORATORIES, BY

ALLIED ANALYTICAL & RESEARCH LABORATORIES

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August 9, 1984

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U S Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas, Texas 75235-8011

ANALYSIS

Sample ID: Site PBA Hole 27-26 8.6-8.9
Acid & Pesticide Extractables

COMPOUND	MDL,ppb	CONC,ppb
2-Chlorophenol	3	NA
Phenol	2	NA
2, 4 Dichlorophenol	3	NA
2-Nitrophenol	4	NA
p-Chloro-m-Cresol	3	NA
2, 4, 6 Trichlorophenol	3	NA
2, 4 Dimethylphenol	3	NA
2, 4 Dinitrophenol	42	NA
2 methyl-4, 6 Dinitrophenol	24	NA
4-Nitrophenol	2	NA
Pentachlorophenol	4	NA
b-Endosulfan	100	NA
a-BHC	100	NA
4-BHC	100	NA
b-BHC	4	NA

NA = Below Minimum Detectable Level.

ALLIED ANALYTICAL & RESEARCH LABORATORIES, BY_____

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U S Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas, Texas 75235-8011

ANALYSIS

Sample ID: Site PBA Hole 27-26 8.9-9.2
Purgeables

COMPOUND	MDL,ppb	CONC,ppb
Chloromethane	17	NA
Bromomethane	17	NA
Vinyl Chloride	17	NA
Chloroethane	17	NA
Methylene Chloride	5	NA
Trichlorofluoromethane	17	NA
1, 1 Dichloroethylene	5	230301
1, 1 Dichloroethane	9	NA
trans-1, 2-Dichloroethylene	3	229
Chloroform	3	4451
1, 2 Dichloroethane	5	193
1, 1, 1 Trichloroethane	7	NA
Carbon Tetrachloride	5	NA
Bromodichloromethane	3	NA
1, 2 Dichloropropane	10	NA

NA = Below Minimum Detectable Level (MDL)

ALLIED ANALYTICAL & RESEARCH LABORATORIES, BY_____

ALLIED ANALYTICAL & RESEARCH LABORATORIES
3031 Glenfield
P.O. Box 24330
Dallas, Texas 75224
Chemists
Consultants & Technologists
214/337-8996

August 9, 1984

SAMPLE Water & Sludge

DATE SUBMITTED 7/20/84

IDENTIFYING MARKS See Below

ANALYTICAL REPORT NO. 63156

SUBMITTED BY
U S Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas, Texas 75235-8011

ANALYSIS

Sample ID: Site PBA Hole 27-26 8.9-9.2
Purgeables

COMPOUND	MDL,ppb	CONC.,ppb
trans-1, 3-Dichloropropylene	9	NA
Trichloroethylene	3	2189
Dibromochloromethane	5	NA
cis-1, 3-Dichloropropylene	17	NA
1, 1, 2-Trichloroethane	9	NA
Benzene	7	30
2-Chloroethylvinylether	17	NA
Bromoform	9	NA
Tetrachloroethylene	7	425263
1, 1, 2, 2 Tetrachloroethane	12	NA
Toluene	10	123
Chlorobenzene	10	143
Ethyl Benzene	12	60
Acrolein	86	NA
Acrylonitrile	86	NA

NA = Below Minimum Detectable Level (MDL)

ALLIED ANALYTICAL & RESEARCH LABORATORIES, BY_____

ALLIED ANALYTICAL & RESEARCH LABORATORIES
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P.O. Box 24330
Dallas, Texas 75224
Chemists
Consultants & Technologists
214/337-8996

August 9, 1984

SAMPLE Water & Sludge

DATE SUBMITTED 7/20/84

IDENTIFYING MARKS See Below

ANALYTICAL REPORT NO. 63156

SUBMITTED BY
U S Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas, Texas 75235-8011

ANALYSIS

Sample ID: Site PBA Hole 27-26 8.9-9.2
Base-Neutral Extractables

COMPOUND	MDL,ppb	CONC.,ppb
1, 3 Dichlorobenzene	598	NA
1, 4 Dichlorobenzene	1195	NA
Hexachloroethane	598	NA
1, 2 Dichlorobenzene	598	NA
Bis (2-chloroisopropyl) ether	1793	NA
Hexachlorobutadiene	299	NA
1, 2, 4 Trichlorobenzene	598	NA
Naphthalene	598	NA
Bis (2-chloroethyl) ether	1793	NA
Hexachlorocyclopentadiene	50	NA
Nitrobenzene	598	NA
Bis (2-chloroethoxy) Methane	1494	NA
2-Chloronaphthalene	598	NA
Acenaphthylene	1195	NA
Acenaphthene	598	NA

NA = Below Minimum Detectable Level (MDL)

ALLIED ANALYTICAL & RESEARCH LABORATORIES, BY_____

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Dallas, Texas 75224
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SUBMITTED BY
U S Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas, Texas 75235-8011

ANALYSIS

Sample ID: Site PBA Hole 27-26 8.9-9.2
Base-Neutral Extractables

COMPOUND	MDL,ppb	CONC.,ppb
Isophorone	598	NA
Fluorene	598	NA
2, 6 Dinitrotoluene	598	NA
1, 2 Diphenylhydrazine	598	NA
2, 4 Dinitrotoluene	1793	NA
n-Nitrosodiphenylamine	598	NA
Hexachlorobenzene	598	NA
4-Bromophenyl Phenyl Ether	598	NA
Phenanthrene	1494	NA
Antharacene	598	NA
Dimethyl Phthalate	598	NA
Diethyl Phthalate	6574	NA
Fluoranthene	598	NA
Pyrene	598	NA
Di-n-butyl Phthalate	598	3122
Benzidene	8964	NA
Butyl Benzyl Phthalate	896	NA

NA = Below Minimum Detectable Level (MDL)

ALLIED ANALYTICAL & RESEARCH LABORATORIES, BY_____

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SUBMITTED BY
U S Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas, Texas 75235-8011

ANALYSIS

Sample ID: Site PBA Hole 27-26 8.9-9.2
Base-Neutral Extractables

COMPOUND	MDL,ppb	CONC.,ppb
Chrysene	896	NA
Bis (2-ethylhexyl) Phthalate	896	NA
Benzo (a) anthracene	2390	NA
Benzo (b) fluoranthene	1494	NA
Benzo (k) fluoranthene	896	NA
Benzo (a) pyrene	896	NA
Indeno (1,2,3-cd) Pyrene	1195	NA
Dibenzo (a,h) anthracene	896	NA
Benzo (g,h,i) perylene	1195	NA
n-Nitrosodimethylamine	100	NA
n-Nitrosodi-n-propylamine	598	NA
4-Chlorophenyl phenyl ether	1195	NA
3, 3' Dichlorobenzidine	5080	NA
2, 3, 7, 8 TCDD	9263	NA
Bis (chloromethyl) ether	1793	NA
Di-n-octyl Phthalate	896	NA

NA = Below Minimum Detectable Level (MDL)

ALLIED ANALYTICAL & RESEARCH LABORATORIES, BY_____

ALLIED ANALYTICAL & RESEARCH LABORATORIES
3031 Glenfield
P.O. Box 24330
Dallas, Texas 75224
Chemists
Consultants & Technologists
214/337-8996

August 9, 1984

SAMPLE Water & Sludge

DATE SUBMITTED 7/20/84

IDENTIFYING MARKS See Below

ANALYTICAL REPORT NO. 63156

SUBMITTED BY
U S Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas, Texas 75235-8011

ANALYSIS

Sample ID: Site PBA Hole 27-26 8.9-9.2
Acid & Pesticide Extractables

COMPOUND	MDL,ppb	CONC,ppb
2-Chlorophenol	3	NA
Phenol	2	NA
2, 4 Dichlorophenol	3	NA
2-Nitrophenol	4	NA
p-Chloro-m-Cresol	3	NA
2, 4, 6 Trichlorophenol	3	NA
2, 4 Dimethylphenol	3	NA
2, 4 Dinitrophenol	42	NA
2 methyl-4, 6 Dinitrophenol	24	NA
4-Nitrophenol	2	NA
Pentachlorophenol	4	NA
b-Endosulfan	100	NA
a-BHC	100	NA
4-BHC	100	NA
b-BHC	4	NA

NA = Below Minimum Detectable Level

ALLIED ANALYTICAL & RESEARCH LABORATORIES. BY_____

3031 Glenfield
P.O. Box 24330
Dallas, Texas 75224

ALLIED ANALYTICAL & RESEARCH LABORATORIES

Chemists
Consultants & Technologists

214/337-8996

August 9, 1984

SAMPLE Water & Sludge **DATE SUBMITTED** 7/20/84

IDENTIFYING MARKS See Below **ANALYTICAL REPORT NO.** 63156

SUBMITTED BY
U S Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas, Texas 75235-8011

ANALYSIS

Sample ID: Site PBA Hole 27-26 8.9-9.2
Acid & Pesticide Extractables

COMPOUNDS	MDL,ppb	CONC,ppb
Aldrin	2	NA
Heptaclor	2	NA
Heptaclor Epoxide	2	NA
a-Endosulfan	100	NA
Dieldrin	3	NA
4, 4'-DDE	6	NA
4, 4'-DDD	3	NA
4, 4'-DDT	5	NA
Endrin	100	NA
Endrin Aldehyde	100	NA
Endosulfan Sulfate	6	NA
d-BHC	3	NA
Chlordane	1000	NA
Toxaphene	5000	NA
PCB (total)	100	NA

NA= Below Minimum Detectable Level (MDL)

H. Morris Weller, President

ALLIED ANALYTICAL & RESEARCH LABORATORIES, BY H Morris Weller CLS

SWD LABORATORY REPORT 13741-11

KEY LABORATORIES
Division of Production Profits
2636 WALNUT HILL LANE SUITE 275
DALLAS, TEX. 75229 214/350-5841

August 23, 1984

REPORT OF ANALYSIS

NUMBER: GH-4049

CLIENT: U.S. Army Corps of Enginners
Southwest Division Laboratory
4815 Cass Street
Dallas, Texas 75235
Attention: Mr. Jeffrey Tye

DESCRIPTION: The client submitted ten soil samples for determination of various parameters. The descriptions of the samples are given on the data sheet.

PROCEDURE: The samples were extracted with hexane and analyzed on a Varian 6000 gas chromatograph under the following conditions:

	1	2
Column	SPB-5 Capillary	SPB-5 Capillary
Detector	ECD at 310°C	FID at 310°C
Column Temp.	45-230°C	45-300°C
Attenuation	1	1

RESULTS: See attached data sheet.

Submitted by:

KEY LABORATORIES

Steve T. Jones, Senior Chemist

STJ/kb

U.S. ARMY CORPS OF ENGINEERS

SOUTHWESTERN DIVISION LABORATORY

DATA SHEET

SAMPLE NUMBER	CH_2CCl_2	$C_2H_2Cl_4$	CCl_3CCl_3	$C_{10}H_8$	TOLUENE
SWD 5328	2.2	<0.01	<0.005	<0.15	0.05
SWD 5330	1.2	<0.02	<0.01	<0.25	0.16
SWD 5338	0.71	<0.01	<0.005	<0.15	0.06
SWD 7323	0.68	0.06	<0.005	<0.15	0.03
SWD 7327	0.07	<0.01	<0.005	<0.15	<0.02
SWD 7389	0.59	0.02	0.02	<0.15	0.06
SWD 7341	0.51	<0.01	<0.005	<0.15	0.06
SWD 7342	0.38	<0.01	<0.005	<0.15	2.3
SWD 7358	2.2	0.03	0.07	<0.15	0.10
SWD 7362	0.65	0.02	<0.005	<0.15	0.23
SWD 7362 Duplicate	0.79	<0.01	<0.005	<0.15	<0.02

Results reported in part per million.

CH_2CCl_2 - Dichloroethylene
$C_2H_2Cl_4$ - Tetrachloroethane
CCl_3CCl_3 - Hexachloroethane
$C_{10}H_8$ - Naphtalene

The above samples are identified as follows:

Sample No 5338: 27-5, J-8, 9.0'-12.0'
" 5330: 27-5, J-10, 15.0-18.0
" 5338: 27-5, J-18, 36.0'-40.0'
" 7323: 27-28, J-6, 7.0'-10.0'
" 7327: 27-28, J-10, 15.5'-17.0'
" 7389: 27-28, J-19, 39.0'-40.0'
" 7341: 27-29, J-9, 13.0'-16.0'
" 7342: 27-29, J-10, 16.0'-17.0'
" 7358: 27-30, J-6, 9.5'-10.0'
" 7362: 27-30, J-10, 17.5'-17.8'

SWD LABORATORY REPORT 13741-12

Table 1

Pine Bluff Arsenal
Site 27

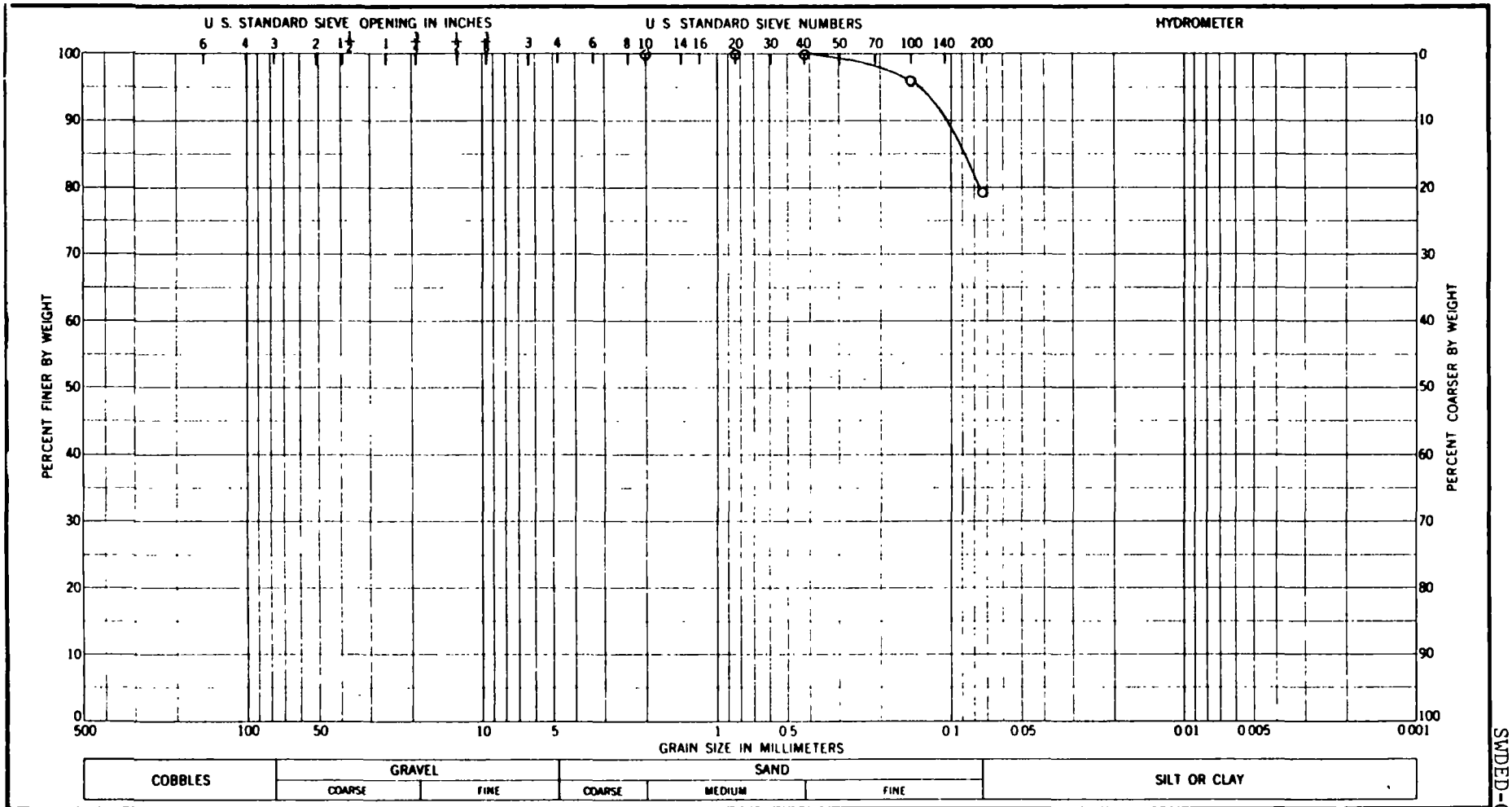
Results of Chemical Analysis of Soil(1)

SWD Lab No	Site Hole	Field No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	pH
G/5325	7-5	J-5	4.0-6.0	<0.5	<1.0		<0.5	<5.0					
5327		J-7	6.0-9.0	<0.5	<1.0		<0.5	<5.0					
5328		J-8	9.0-12.0			110				6.7		2.8	
5330		J-10	15.0-18.0			<20				4.8		7.7	
5338		J-18	36.0-40.0			780				410		63	
7323	7-28	J-6	7.0-10.0			660				5.0		1.9	
7327		J-10	15.5-17.0			140				5.5		2.8	
7389		J-19	39.0-40.0			380				7.9		18	
7341	7-29	J-9	13.0-16.0			<20				2.9		2.4	
7342		J-10	16.0-17.0			<20				1.9		1.8	
7358	7-30	J-6	9.5-10.0			130				4.5		9.9	
7362		J-10	17.5-17.8			22				8.9		5.8	
Minimum Reported Concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0	

(1) Results reported in mg/kg

SWD LABORATORY REPORT 13741-13

BORING NO.	FLD NO.	SWD NO.	DEPTH, FT.	GR	SA	FI	LL	PL	PI	LS	WC, %	PCF	K, CM/SEC	DECRIPTION OF MATERIAL
														PINE BLUFF ARSENAL-SWDED-GL-REPORT NO. 13741-13-SITE 27
27- 30	D-1	84/5145	18.1-20.1	0	21	79	25	14	11		20.4	106	6.3 X 10-9	CL - CLAY, SANDY, BROWN GRAY, MOIST, MEDIUM CONSISTENCY.



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
84/5145	18.1-20.1	CLAY, sandy (CL)	20.4	25	14	11

Project: Pine Bluff Arsenal-Site 27

Area:

Boring No: 27-30

Date: Sept 84

GRADATION CURVES

ENG FORM 1 MAY 63 2087

Plate 1

SWDED-GL Report No. 13741-13

SWD LABORATORY REPORT 13741-14

SWDED-GL Report 13741-14

Table 1

Pine Bluff Arsenal

Results of Chemical Analysis of Soil(1)

Site 27

SWD Lab No	Site Hole	Field No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	pH
6585	15	J- 3	2.0- 3.0			80				10			
6586		J- 4	3.0- 5.0			61				9.8			
7324	28	J- 7	10.0-11.0			1400				3.9			
7325		J- 8	11.0-14.0			1200				6.4			
7326		J- 9	14.0-15.5			820				4.3			
7328		J-11	17.0-18.0			98				9.5			
7330		J-13	20.0-22.5			120				14			
7332		J-15	25.5-28.5			20				2.8			
7387		J-17	31.5-36.0			32				3.3			
Minimum Reported Concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0	

(1) Results reported in mg/kg

SWD LABORATORY REPORT 13741-15

SWDED-GL Report 13741-15

Table 1

Pine Bluff Arsenal
Site 27

Results of Chemical Analysis of Soil(1)

SWD Lab No	Site Hole	Field No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	pH
7573	31	J-1	0.0 - 1.0			1100				55			
7575		J-3	2.0 - 3.0			43				<1.0			
7577		J-5	6.0 - 9.5			140				1.0			
7579		J-7	12.5 - 15.0			26				2.4			
7580	32	J-1	0.0 - 1.3			190	0.6	820		780			
7582		J-3	2.3 - 3.3			66	<0.5	22		21			
7584		J-5	6.0 - 7.5			240	<0.5	16		19			
7587		J-8	13.0 - 15.0			80	<0.5	8.8		11			
7588	33	J-1	0.0 - 1.0			660	2.4	1400		34			
7590		J-3	2.0 - 3.0			54	<0.5	190		5.7			
7592		J-5	6.0 - 9.0			41	<0.5	94		3.4			
7594		J-7	12.0 - 15.0			<20	<0.5	7.1		11			
7526	34	J-1	0.0 - 1.0			<20	<0.5	<5.0		7.3			
7528		J-3	2.0 - 3.0			166	<0.5	27		13			
7530		J-5	5.0 - 6.5			<20	<0.5	5.0		4.5			
7533		J-8	12.5 - 15.0			<20	<0.5	<5.0		12			
7595	35	J-1	0.0 - 1.0			200				13			
7597		J-3	2.0 - 3.5			34				7.6			
7599		J-5	6.0 - 7.5			220				2.0			
7602		J-8	12.0 - 15.0			54				1.8			
Minimum Reported Concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0	

(1) Results reported in mg/kg

Table 1 Cond't

Pine Bluff Arsenal
Site 27

Results of Chemical Analysis of Soil(1)

SWD Lab No	Site Hole	Field No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	pH
7603	36	J-1	0.0 - 1.0			56				11			
7605		J-3	2.0 - 3.0			43				10			
7607		J-5	6.0 - 8.8			110				2.1			
7609		J-7	11.8 - 15.0			10				1.7			
7610	37	J-1	0.0 - 1.0			490				5.4			
7612		J-3	2.0 - 3.0			230				5.4			
7656		J-5	6.0 - 9.0			450				8.2			
7658		J-7	11.6 - 15.0			100				11			
7614	38	J-1	0.0 - 1.0			200				1.0			
7616		J-3	2.0 - 3.0			200				4.9			
7618		J-5	6.0 - 9.5			23				1.9			
7620		J-7	12.5 - 15.0			72				11			
7659	39	J-1	0.0 - 1.2			180				9.8			
7661		J-3	2.2 - 3.2			29				8.2			
7663		J-5	6.2 - 9.2			1200				4.5			
7665		J-7	11.2 - 15.0			28				8.8			
Minimum Reported Concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0	

(1) Results reported in mg/kg

SWD LABORATORY REPORT 13741-16

Results of Chemical Analysis of Soil(1)

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn
10	J-1	5353	0.0- 1.0					58				
	J-2	5354	1.0- 3.0					30				
	J-3	5355	3.0- 5.0					21				
18	J-1	6543	0.0- 0.7				<0.5	31				
	J-2	6544	0.7- 1.7				<0.5	67				
	J-4	6546	2.7- 5.0				<0.5	34				
19	J-1	6547	0.0- 1.0				<0.5	210				
	J-2	6548	1.0- 2.0				<0.5	5.9				
	J-3	6549	2.0- 2.7				<0.5	<5.0				
20	J-1	6552	0.0- 1.0				1.5	430				
	J-3	6554	2.1- 3.1				<0.5	5.9				
	J-4	6555	3.1- 7.0				<0.5	<5.0				
31	J-1	7573	0.0- 1.0				2.2	250				
	J-3	7575	2.0- 3.0				<0.5	10				
	J-5	7577	6.0- 9.5				0.59	<5.0				
	J-7	7579	12.5-15.0				<0.5	40				
32	J-2	7581	1.3- 2.3			1200		230				
33	J-2	7589	1.0- 2.0			2600	1.3	710				
	J-6	7593	9.0-12.0			<20	<0.5	<5.0				
35	J-1	7595	0.0- 1.0				0.5	140				
	J-3	7597	2.0- 3.5				<0.5	20				
Minimum reported concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0

(1) Results reported in mg/kg

Results of Chemical Analysis of Soil(1)

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	
35	J-6	7600	7.5-10.5				<0.5	<5.0					
	J-8	7602	12.0-15.0				<0.5	5.9					
36	J-1	7603	0.0- 1.0				<0.5	5.3					
	J-3	7605	2.0- 3.0				<0.5	9.2					
	J-5	7607	6.0- 8.8				<0.5	<5.0					
	J-7	7609	11.8-15.0				<0.5	<5.0					
37	J-1	7610	0.0- 1.0					26					
	J-3	7612	2.0- 3.0					5.2					
	J-5	7656	6.0- 9.0					<5.0					
	J-7	7658	11.6-15.0					<5.0					
38	J-1	7614	0.0- 1.0				<0.5	5.6					
	J-3	7616	2.0- 3.0				<0.5	<5.0					
	J-5	7618	6.0- 9.5				<0.5	<5.0					
	J-7	7620	12.5-15.0				<0.5	<5.0					
39	J-1	7659	0.0- 1.2					16					
	J-3	7661	2.2- 3.2					6.4					
	J-5	7663	6.2- 9.2					<5.0					
	J-7	7665	11.2-15.0					<5.0					
Minimum reported concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0	

(1) Results reported in mg/kg

SWD LABORATORY REPORT 13741-18

(NO REPORT 13741-17)

Table 1

Results of Chemical Analysis of Soil[1]

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn
40	J- 1	G/8126	6.6- 8.3			3800	7.6	5600		600		680
	J- 2	8127	8.3-10.3			16000	7.8	6200		410		610
	J- 3	8128	10.8-12.9			4800	7.9	6700		61		550
	J- 4	8129	12.9-14.9			7100	7.0	4700		380		350
	J- 5	8130	14.9-16.9			2900	1.6	100		31		24
	J- 6	8131	16.9-18.9			64	<0.5	15		8.0		7.6
	J- 7	8132	18.9-20.0			47	<0.5	<5.0		11		11
	J- 8	8133	20.0-21.4			56	<0.5	7.4		17		32
	J- 9	8134	21.4-23.4			28	<0.5	<5.0		63		23
	J-10	8135	23.4-26.4			<20	<0.5	<5.0		2.7		8.2
	J-11	8136	26.4-28.3			<20	<0.5	<5.0		4.0		7.5
Minimum reported concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0

(1) Results reported in mg/kg

Table 2

ALLIED ANALYTICAL & RESEARCH LABORATORIES
Chemists
Consultants & Technologists
3031 Glenfield
P.O. Box 24330
Dallas, Texas 75224
214/337-6096

SAMPLE Soil

IDENTIFYING MARKS PBA Hole #27-40 Jar #3
10.9 to 12.9 8128

DATE SUBMITTED 11/26/84

ANALYTICAL REPORT NO. 63732

SUBMITTED BY U.S.Army Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas, TX 75235-8011

ANALYSIS

U.S.E.P.A. Method 8270
Base-Neutral Extractables

COMPOUND	MDL, ppb	Conc.ppb
Antharacene	626	NA
Dimethyl phthalate	626	NA
Diethyl phthalate	6883	NA
Fluoranthene	626	NA
Pyrene	626	NA
Di-n-butyl phthalate	626	NA
Benzidene	9386	NA
Butyl benzyl phthalate	939	NA
Chrysene	939	NA
Bis(2-ethylhexyl)phthalate	939	NA
Benzo (a) anthracene	2503	NA
Benzo (b) fluoranthene	1564	NA
Benzo (k) fluoranthene	939	NA
Benzo (a) pyrene	939	NA
Indeno (1,2,3-cd) pyrene	1251	NA
Dibenzo (a,h) anthracene	939	NA
Benzo (g,h,i) perylene	1251	NA
n-Nitrosodimethylamine	626	NA
n-Nitrosodi-n-propylamine	626	NA
4-Chlorophenyl phenyl ether	1251	NA
3,3' Dichlorobenzidine	5319	NA
2,3,7,8 TCDD	9699	NA
Bis (chloromethyl) ether	1877	NA
Di-n-octyl phthalate	939	NA

NA = Below minimum detectable level (MDL)

ALLIED ANALYTICAL & RESEARCH LABORATORIES, BY_____

ALLIED ANALYTICAL & RESEARCH LABORATORIES
Chemists
Consultants & Technologists
3031 Glenfield
P.O. Box 24330
Dallas, Texas 75224
214/337-0996

SAMPLE Soil

IDENTIFYING MARKS PBA Hole #27-40 Jar #3
10.9 to 12.9 8128

DATE SUBMITTED 11/26/84

ANALYTICAL REPORT NO. 63732

SUBMITTED BY U.S.Army Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas, TX 75235-8011

ANALYSIS

U.S.E.P.A. Method 8270
Base-Neutral Extractables

COMPOUND	MDL, ppb	Conc.ppb
1,3 Dichlorobenzene	626	NA
1,4 Dichlorobenzene	1251	NA
Hexachloroethane	626	NA
1,2 Dichlorobenzene	626	NA
Bis(2-chloroisopropyl)ether	1877	NA
Hexachlorobutadiene	626	NA
1,2,4 Trichlorobenzene	626	NA
Naphthalene	626	NA
Bis (2-chloroethyl) Ether	626	NA
Hexachlorocyclopentadiene	626	NA
Nitrobenzene	626	NA
Bis(2-chloroethoxy)Methane	1564	NA
2-Chloronaphthalene	626	NA
Acenaphthylene	1251	NA
Acenaphthene	626	NA
Isophorone	626	NA
Fluorene	626	NA
2,6 Dinitrotoluene	626	NA
1,2 Diphenylhydrazine	626	NA
2,4 Dinitrotoluene	1877	NA
n-Nitrosodiphenylamine	626	NA
Hexachlorobenzene	626	NA
4-Bromophenyl phenyl ether	626	NA
Phenanthrene	626	NA

NA = Below minimum detectable level (MDL)

ALLIED ANALYTICAL & RESEARCH LABORATORIES, BY_____

ALLIED ANALYTICAL & RESEARCH LABORATORIES
Chemists
Consultants & Technologists
3031 Glenfield
P.O. Box 24330
Dallas, Texas 75224
214/337-8996

SAMPLE Soil

DATE SUBMITTED 11/26/84

IDENTIFYING MARKS PBA Hole #27-40 Jar #3
10.9 to 12.9 8128

ANALYTICAL REPORT NO. 63732

SUBMITTED BY U.S.Army Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas, TX 75235-8011

ANALYSIS

U.S.E.P.A. Method 8270
Acid & Pesticide Extractables

COMPOUND	MDL, ppb	Conc.ppb
2-Chlorophenol	939	NA
Phenol	626	NA
2,4 Dichlorophenol	939	NA
2-Nitrophenol	1251	NA
p-Chloro-m-Cresol	939	NA
2,4,6 Trichlorophenol	939	NA
2,4 Dimethylphenol	939	NA
2,4 Dinitrophenol	13141	NA
2-Methyl-4,6 Dinitrophenol	7509	NA
4-Nitrophenol	626	NA
Pentachlorophenol	1251	NA
b-Endosulfan	31287	NA
a-BHC	31287	NA
y-BHC	31287	NA
b-BHC	1251	NA
Aldrin	626	NA
Heptaclor	626	NA
Heptaclor epoxide	626	NA
a-Endosulfan	31287	NA
Dieldrin	939	NA
4,4'-DDE	1877	NA
4,4'-DDD	939	NA
4,4'-DDT	1251	NA
Endrin	31287	NA
Endrin Aldehyde	31287	NA
Endosulfan sulfate	1877	NA
d-BHC	939	NA
Chlordane	312871	NA
Toxaphene	1564356	NA
PCB (total)	31287	NA

NA = Below minimum detectable level (MDL)

ALLIED ANALYTICAL & RESEARCH LABORATORIES, BY_____

ALLIED ANALYTICAL & RESEARCH LABORATORIES
Chemists
Consultants & Technologists
3031 Glenfield
P.O. Box 24330
Dallas, Texas 75224
214/337-8996

SAMPLE Soil

DATE SUBMITTED 11/26/84

IDENTIFYING MARKS PBA Hole #27-40 Jar #3
10.9 to 12.9 8128

ANALYTICAL REPORT NO. 63732

SUBMITTED BY U.S.Army Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas TX, 75235-8011

ANALYSIS

Purgeable Organic Compounds
U.S.E.P.A. Method 8240

COMPOUND	MDL ppb	Conc ppb
Chloromethane	35	NA
Bromomethane	35	NA
Vinyl Chloride	35	NA
Chloroethane	35	NA
Methylene Chloride	18	NA
Trichlorofluoromethane	13	NA
1,1 Dichloroethylene	16	NA
1,1 Dichloroethane	13	NA
trans-1,2-Dichloroethylene	13	NA
Chloroform	12	NA
1,2 Dichloroethane	14	NA
1,1,1 Trichloroethane	16	NA
Carbon Tetrachloride	20	NA
Bromodichloromethane	17	NA
1,2 Dichloropropane	13	NA
trans-1,3-Dichloropropylene	17	NA
Trichloroethylene	33	NA
Dibromochloromethane	10	NA
cis-1,3-Dichloropropylene	35	NA
1,1,2 Trichloroethane	17	NA
Benzene	11	NA
2-Chloroethylvinylether	35	NA
Bromoform	17	NA
Tetrachloroethylene	43	NA
1,1,2,2 Tetrachloroethane	24	NA
Toluene	8	NA
Chlorobenzene	14	NA
Ethyl Benzene	4	NA
Acrolein	173	NA
Acrylonitrile	173	NA

NA = below minimum detectable level (MDL)

ALLIED ANALYTICAL & RESEARCH LABORATORIES, BY_____

ALLIED ANALYTICAL & RESEARCH LABORATORIES
Chemists
Consultants & Technologists
3031 Glenfield
P.O. Box 24330
Dallas, Texas 75224
214/337-8996

SAMPLE: Soil

IDENTIFYING MARKS: PBA Hole #27-40 Jar #4 12.9 to 14.9 8129

DATE SUBMITTED: 11/26/84

ANALYTICAL REPORT NO.: 63732

SUBMITTED BY: U.S.Army Corp of Engineers
Attn: Jeff Tye

ADDRESS: 4815 Cass
Dallas, TX 75235-8011

ANALYSIS

U.S.E.P.A. Method 8270
Base-Neutral Extractables

COMPOUND	MDL, ppb	Conc.ppb
Antharacene	351	NA
Dimethyl phthalate	351	NA
Diethyl phthalate	3856	NA
Fluoranthene	351	NA
Pyrene	351	NA
Di-n-butyl phthalate	351	NA
Benzidene	5258	NA
Butyl benzyl phthalate	526	NA
Chrysene	526	NA
Bis(2-ethylhexyl)phthalate	526	NA
Benzo (a) anthracene	1402	NA
Benzo (b) fluoranthene	876	NA
Benzo (k) fluoranthene	526	NA
Benzo (a) pyrene	526	NA
Indeno (1,2,3-cd) pyrene	701	NA
Dibenzo (a,h) anthracene	526	NA
Benzo (g,h,i) perylene	701	NA
n-Nitrosodimethylamine	351	NA
n-Nitrosodi-n-propylamine	351	NA
4-Chlorophenyl phenyl ether	701	NA
3,3' Dichlorobenzidine	2979	NA
2,3,7,8 TCDD	5433	NA
Bis (chloromethyl) ether	1052	NA
Di-n-octyl phthalate	526	NA

NA = Below minimum detectable level (MDL)

ALLIED ANALYTICAL & RESEARCH LABORATORIES, BY_____

Table 2 (Cont'd)

ALLIED ANALYTICAL & RESEARCH LABORATORIES
Chemists
Consultants & Technologists
3031 Glenfield
P.O. Box 24330
Dallas, Texas 75224
214/337-8996

SAMPLE Soil

IDENTIFYING MARKS PBA Hole #27-40 Jar #4
12.9 to 14.9 8129

DATE SUBMITTED 11/26/84

ANALYTICAL REPORT NO. 63732

SUBMITTED BY U.S.Army Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas, TX 75235-8011

ANALYSIS

U.S.E.P.A. Method 8270
Base-Neutral Extractables

COMPOUND	MDL, ppb	Conc.ppb
1,3 Dichlorobenzene	351	NA
1,4 Dichlorobenzene	701	NA
Hexachloroethane	351	NA
1,2 Dichlorobenzene	351	NA
Bis(2-chloroisopropyl)ether	1052	NA
Hexachlorobutadiene	351	NA
1,2,4 Trichlorobenzene	351	NA
Naphthalene	351	NA
Bis (2-chloroethyl) Ether	351	NA
Hexachlorocyclopentadiene	351	NA
Nitrobenzene	351	NA
Bis(2-chloroethoxy)Methane	876	NA
2-Chloronaphthalene	351	NA
Acenaphthylene	701	NA
Acenaphthene	351	NA
Isophorone	351	NA
Fluorene	351	NA
2,6 Dinitrotoluene	351	NA
1,2 Diphenylhydrazine	351	NA
2,4 Dinitrotoluene	1052	NA
n-Nitrosodiphenylamine	351	NA
Hexachlorobenzene	351	NA
4-Bromophenyl phenyl ether	351	NA
Phenanthrene	351	NA

NA = Below minimum detectable level (MDL)

ALLIED ANALYTICAL & RESEARCH LABORATORIES, BY_____

Table 2 (Cont'd)

ALLIED ANALYTICAL & RESEARCH LABORATORIES
Chemists
Consultants & Technologists
3031 Glenfield
P.O. Box 24330
Dallas, Texas 75224
214/337-8996

SAMPLE Soil
DATE SUBMITTED 11/26/84
IDENTIFYING MARKS PBA Hole #27-40 Jar #4 12.9 to 14.9 8129
ANALYTICAL REPORT NO. 63732
SUBMITTED BY U.S.Army Corp of Engineers
Attn: Jeff Tye
ADDRESS 4815 Cass
Dallas, TX 75235-8011

ANALYSIS

U.S.E.P.A. Method 8270
Acid & Pesticide Extractables

COMPOUND	MDL, ppb	Conc.ppb
2-Chlorophenol	526	NA
Phenol	351	NA
2,4 Dichlorophenol	526	NA
2-Nitrophenol	701	NA
p-Chloro-m-Cresol	526	NA
2,4,6 Trichlorophenol	526	NA
2,4 Dimethylphenol	526	NA
2,4 Dinitrophenol	7361	NA
2-Methyl-4,6 Dinitrophenol	4206	NA
4-Nitrophenol	351	NA
Pentachlorophenol	701	NA
b-Endosulfan	17525	NA
a-BHC	17525	NA
y-BHC	17525	NA
b-BHC	701	NA
Aldrin	351	NA
Heptaclor	351	NA
Heptaclor epoxide	351	NA
a-Endosulfan	17525	NA
Dieldrin	526	NA
4,4'-DDE	1052	NA
4,4'-DDD	526	NA
4,4'-DDT	701	NA
Endrin	17525	NA
Endrin Aldehyde	17525	NA
Endosulfan sulfate	1052	NA
d-BHC	526	NA
Chlordane	175253	NA
Toxaphene	876263	NA
PCB (total)	17525	NA

NA = Below minimum detectable level (MDL)

ALLIED ANALYTICAL & RESEARCH LABORATORIES, BY_____

ALLIED ANALYTICAL & RESEARCH LABORATORIES
Chemists
Consultants & Technologists
3031 Glenfield
P.O. Box 24330
Dallas, Texas 75224
214/337-8996

SAMPLE Soil

DATE SUBMITTED 11/26/84

IDENTIFYING MARKS PBA Hole #27-40 Jar #4
12.9 to 14.9 8129

ANALYTICAL REPORT NO. 63732

SUBMITTED BY U.S.Army Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas TX, 75235-8011

ANALYSIS

Purgeable Organic Compounds
U.S.E.P.A. Method 8240

COMPOUND	MDL ppb	Conc ppb
Chloromethane	31	NA
Bromomethane	31	NA
Vinyl Chloride	31	NA
Chloroethane	31	NA
Methylene Chloride	16	NA
Trichlorofluoromethane	12	NA
1,1 Dichloroethylene	14	NA
1,1 Dichloroethane	12	NA
trans-1,2-Dichloroethylene	12	NA
Chloroform	11	NA
1,2 Dichloroethane	13	NA
1,1,1 Trichloroethane	14	NA
Carbon Tetrachloride	18	NA
Bromodichloromethane	15	NA
1,2 Dichloropropane	12	NA
trans-1,3-Dichloropropylene	16	NA
Trichloroethylene	29	NA
Dibromochloromethane	9	NA
cis-1,3-Dichloropropylene	31	NA
1,1,2 Trichloroethane	15	NA
Benzene	10	NA
2-Chloroethylvinylether	31	NA
Bromoform	15	NA
Tetrachloroethylene	39	NA
1,1,2,2 Tetrachloroethane	22	NA
Toluene	7	NA
Chlorobenzene	12	NA
Ethyl Benzene	4	NA
Acrolein	155	NA
Acrylonitrile	155	NA

NA = below minimum detectable level (MDL)

ALLIED ANALYTICAL & RESEARCH LABORATORIES, BY_____

ALLIED ANALYTICAL & RESEARCH LABORATORIES
Chemists
Consultants & Technologists
3031 Glenfield
P.O. Box 24330
Dallas, Texas 75224
214/337-8996

SAMPLE: Soil

IDENTIFYING MARKS: PBA Hole #27-40 Jar #5 14.9 to 16.9 8130

DATE SUBMITTED: 11/26/84

ANALYTICAL REPORT NO.: 63732

SUBMITTED BY: U.S.Army Corp of Engineers
Attn: Jeff Tye

ADDRESS: 4815 Cass
Dallas, TX 75235-8011

ANALYSIS

U.S.E.P.A. Method 8270
Base-Neutral Extractables

COMPOUND	MDL, ppb	Conc.ppb
Antharacene	674	NA
Dimethyl phthalate	674	NA
Diethyl phthalate	7413	NA
Fluoranthene	674	NA
Pyrene	674	NA
Di-n-butyl phthalate	674	NA
Benzidene	10108	NA
Butyl benzyl phthalate	1011	NA
Chrysene	1011	NA
Bis(2-ethylhexyl)phthalate	1011	NA
Benzo (a) anthracene	2695	NA
Benzo (b) fluoranthene	1685	NA
Benzo (k) fluoranthene	1011	NA
Benzo (a) pyrene	1011	NA
Indeno (1,2,3-cd) pyrene	1348	NA
Dibenzo (a,h) anthracene	1011	NA
Benzo (g,h,i) perylene	1348	NA
n-Nitrosodimethylamine	674	NA
n-Nitrosodi-n-propylamine	674	NA
4-Chlorophenyl phenyl ether	1348	NA
3,3' Dichlorobenzidine	5728	NA
2,3,7,8 TCDD	10445	NA
Bis (chloromethyl) ether	2022	NA
Di-n-octyl phthalate	1011	NA

NA = Below minimum detectable level (MDL)

ALLIED ANALYTICAL & RESEARCH LABORATORIES, BY_____

ALLIED ANALYTICAL & RESEARCH LABORATORIES
Chemists
Consultants & Technologists
3031 Glenfield
P.O. Box 24330
Dallas, Texas 75224
214/337-8996

SAMPLE: Soil
IDENTIFYING MARKS: PBA Hole #27-40 Jar #5 14.9 to 16.9 8130
DATE SUBMITTED: 11/26/84
ANALYTICAL REPORT NO.: 63732
SUBMITTED BY: U.S.Army Corp of Engineers
Attn: Jeff Tye
ADDRESS: 4815 Cass
Dallas, TX 75235-8011

ANALYSIS

U.S.E.P.A. Method 8270
Base-Neutral Extractables

COMPOUND	MDL, ppb	Conc.ppb
1,3 Dichlorobenzene	674	NA
1,4 Dichlorobenzene	1348	NA
Hexachloroethane	674	NA
1,2 Dichlorobenzene	674	NA
Bis(2-chloroisopropyl)ether	2022	NA
Hexachlorobutadiene	674	NA
1,2,4 Trichlorobenzene	674	NA
Naphthalene	674	NA
Bis (2-chloroethyl) Ether	674	NA
Hexachlorocyclopentadiene	674	NA
Nitrobenzene	674	NA
Bis(2-chloroethoxy)Methane	1685	NA
2-Chloronaphthalene	674	NA
Acenaphthylene	1348	NA
Acenaphthene	674	NA
Isophorone	674	NA
Fluorene	674	NA
2,6 Dinitrotoluene	674	NA
1,2 Diphenylhydrazine	674	NA
2,4 Dinitrotoluene	2022	NA
n-Nitrosodiphenylamine	674	NA
Hexachlorobenzene	674	NA
4-Bromophenyl phenyl ether	674	NA
Phenanthrene	674	NA

NA = Below minimum detectable level (MDL)

ALLIED ANALYTICAL & RESEARCH LABORATORIES, BY_____

Table 2 (Cont'd)

ALLIED ANALYTICAL & RESEARCH LABORATORIES
Chemists
Consultants & Technologists
3031 Glenfield
P.O. Box 24330
Dallas, Texas 75224
214/337-8996

SAMPLE Soil
IDENTIFYING MARKS PBA Hole #27-40 Jar #5 14.9 to 16.9 8130
SUBMITTED BY U.S.Army Corp of Engineers Attn: Jeff Tye

DATE SUBMITTED 11/26/84
ANALYTICAL REPORT NO. 63732
ADDRESS 4815 Cass Dallas, TX 75235-8011

ANALYSIS

U.S.E.P.A. Method 8270
Acid & Pesticide Extractables

COMPOUND	MDL, ppb	Conc.ppb
2-Chlorophenol	1011	NA
Phenol	674	NA
2,4 Dichlorophenol	1011	NA
2-Nitrophenol	1348	NA
p-Chloro-m-Cresol	1011	NA
2,4,6 Trichlorophenol	1011	NA
2,4 Dimethylphenol	1011	NA
2,4 Dinitrophenol	14151	NA
2-Methyl-4,6 Dinitrophenol	8086	NA
4-Nitrophenol	674	NA
Pentachlorophenol	1348	NA
b-Endosulfan	33694	NA
a-BHC	33694	NA
y-BHC	33694	NA
b-BHC	1348	NA
Aldrin	674	NA
Heptaclor	674	NA
Heptaclor epoxide	674	NA
a-Endosulfan	33694	NA
Dieldrin	1011	NA
4,4'-DDE	2022	NA
4,4'-DDD	1011	NA
4,4'-DDT	1348	NA
Endrin	33694	NA
Endrin Aldehyde	33694	NA
Endosulfan sulfate	2022	NA
d-BHC	1011	NA
Chlordane	336935	NA
Toxaphene	1684676	NA
PCB (total)	33694	NA

NA = Below minimum detectable level (MDL)

ALLIED ANALYTICAL & RESEARCH LABORATORIES, BY_____

ALLIED ANALYTICAL & RESEARCH LABORATORIES
Chemists
Consultants & Technologists
3031 Glenfield
P.O. Box 24330
Dallas, Texas 75224
214/337-8996

SAMPLE Soil

DATE SUBMITTED 11/26/84

IDENTIFYING MARKS PBA Hole #27-40 Jar #5
14.9 to 16.9 8130

ANALYTICAL REPORT NO. 63732

SUBMITTED BY U.S.Army Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass
Dallas TX, 75235-8011

ANALYSIS

Purgeable Organic Compounds
U.S.E.P.A. Method 8240

COMPOUND	MDL ppb	Conc ppb
Chloromethane	36	NA
Bromomethane	36	NA
Vinyl Chloride	36	NA
Chloroethane	36	NA
Methylene Chloride	19	NA
Trichlorofluoromethane	14	NA
1,1 Dichloroethylene	16	NA
1,1 Dichloroethane	14	NA
trans-1,2-Dichloroethylene	14	NA
Chloroform	13	NA
1,2 Dichloroethane	15	NA
1,1,1 Trichloroethane	16	NA
Carbon Tetrachloride	21	NA
Bromodichloromethane	17	NA
1,2 Dichloropropane	14	NA
trans-1,3-Dichloropropylene	18	NA
Trichloroethylene	34	NA
Dibromochloromethane	11	NA
cis-1,3-Dichloropropylene	36	NA
1,1,2 Trichloroethane	18	NA
Benzene	12	NA
2-Chloroethylvinylether	36	NA
Bromoform	18	NA
Tetrachloroethylene	45	64
1,1,2,2 Tetrachloroethane	25	NA
Toluene	9	NA
Chlorobenzene	15	NA
Ethyl Benzene	5	NA
Acrolein	181	NA
Acrylonitrile	181	NA

NA = below minimum detectable level (MDL)

H. Morris Weller, President

ALLIED ANALYTICAL & RESEARCH LABORATORIES, BY H. Morris Weller

APPENDIX II
BORING - CONTAMINANT PLOTS

LEGEND

CONTAMINATED DEBRIS AND RUBBLE

SAND AND GRAVEL

SILT AND SANDY CLAY

CLAY

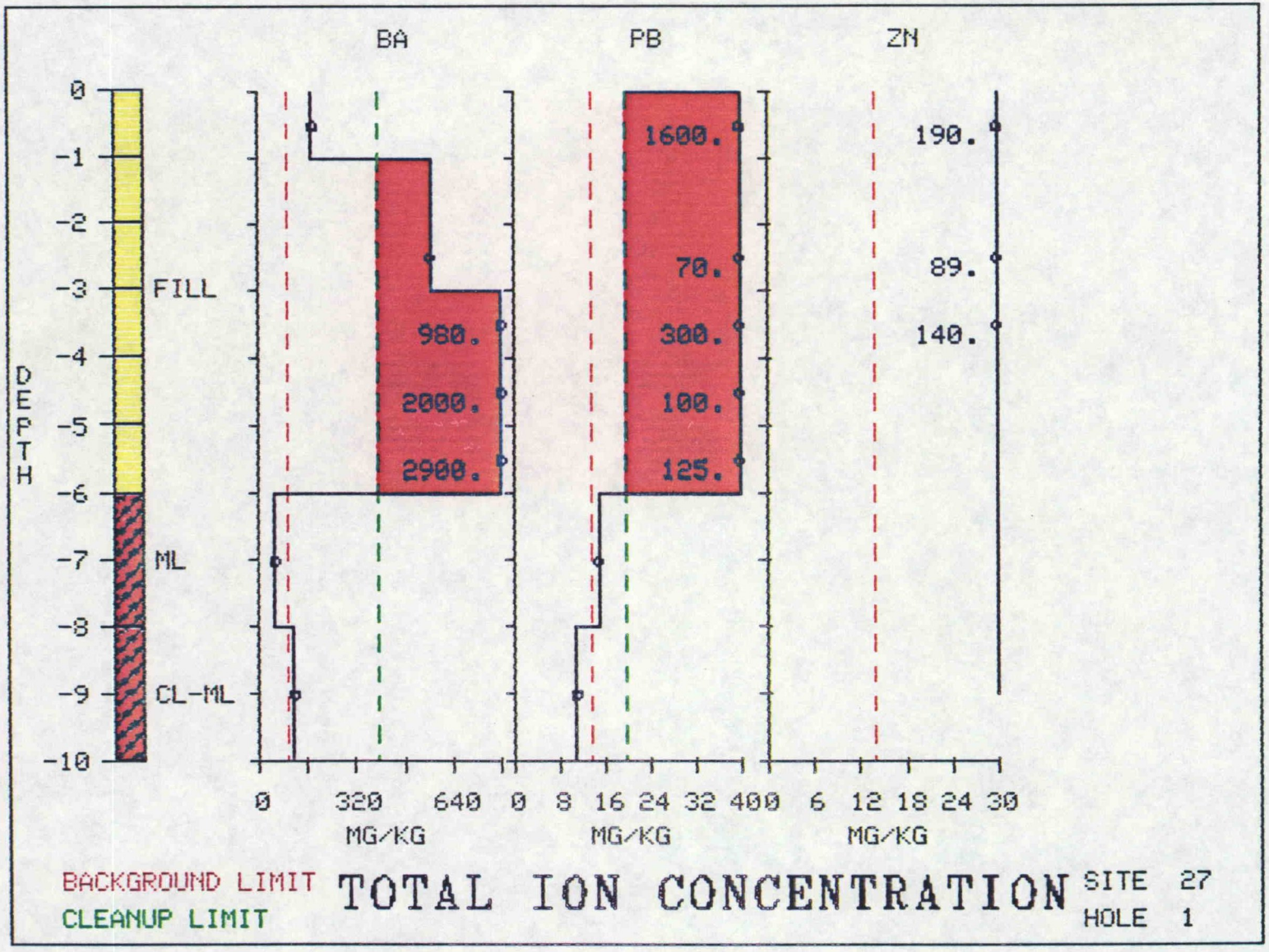
CLAY SHALE OR SILTSTONE
OF THE JACKSON GROUP

SAND OR POORLY CEMENTED SANDSTONE
OF THE JACKSON GROUP

MIDDEPTH OF SOIL SAMPLE TESTED

BACKGROUND LIMIT - Upper limits of 95% confidence interval for those contiminants with measurable background concentrations

CLEANUP LIMIT - Concentration to which site will be cleaned up. The color "red" to the right of the cleanup limit indicates contamination.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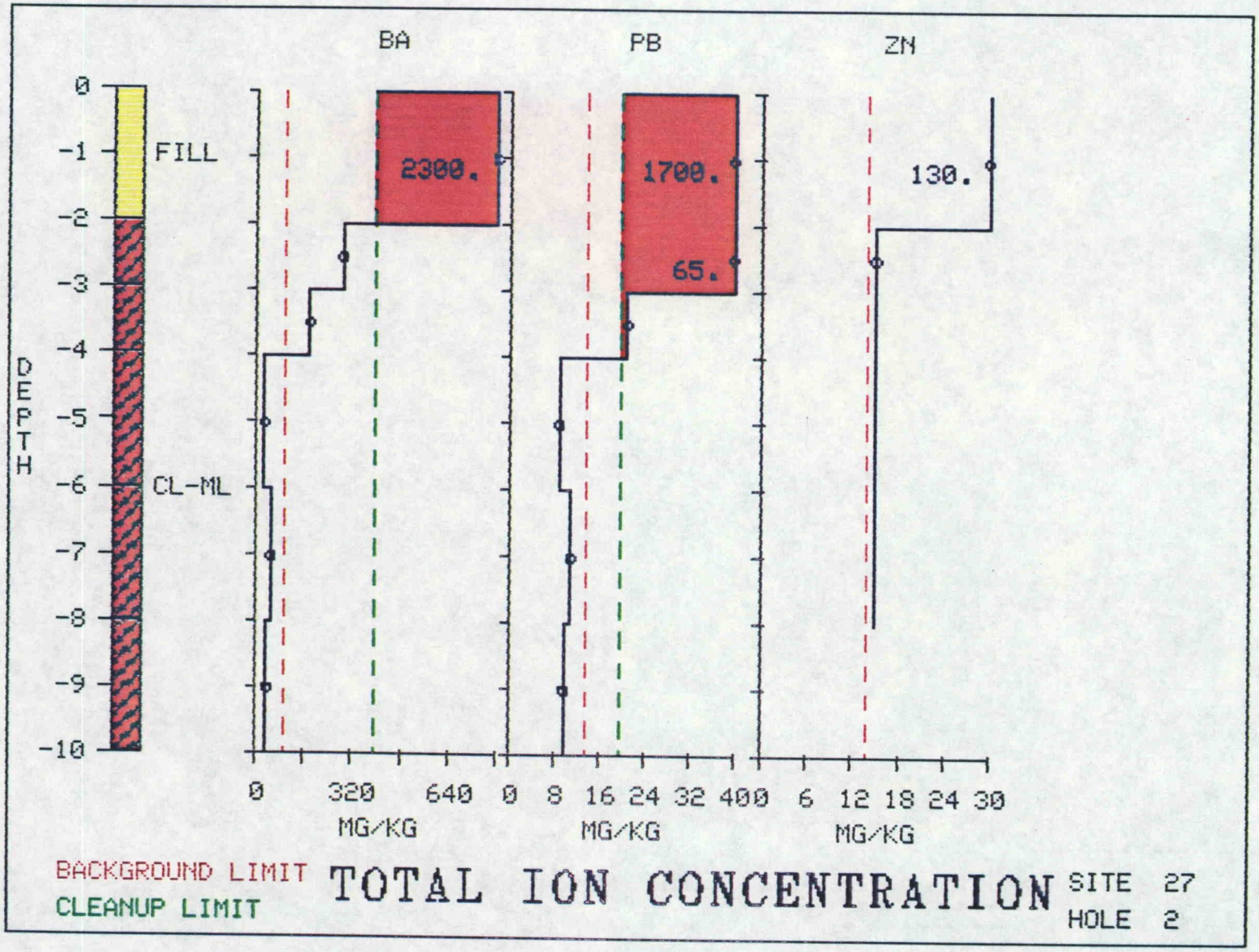
PB
ZN
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
DEPTH
FILL
ML
CL-ML
980.
2000.
2900.
1600.
70.
300.
100.
125.
190.
89.
140.
0
320
640
MG/KG
0
8
16
24
32
400
MG/KG
6
12
18
24
30
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 1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PB
ZN
0
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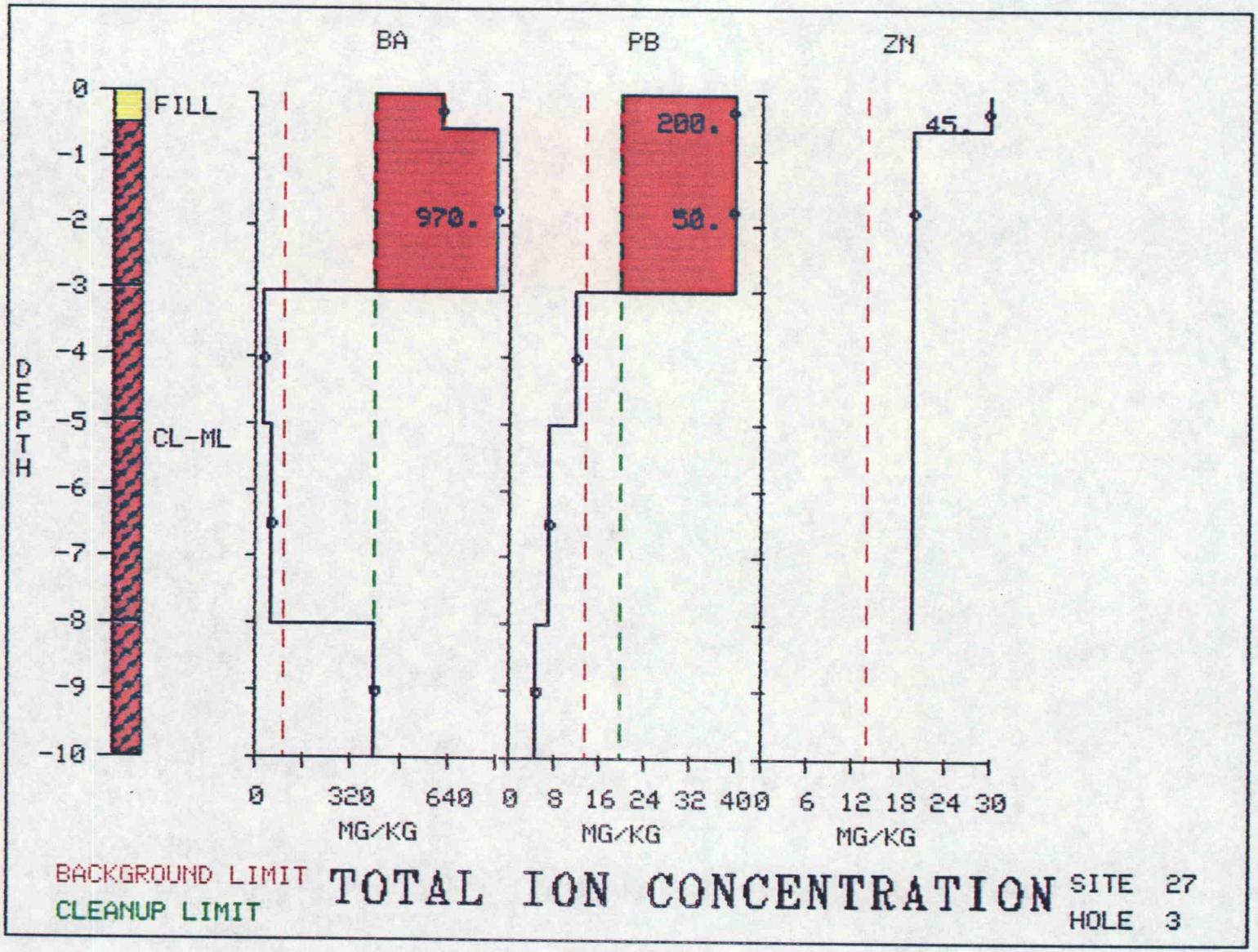
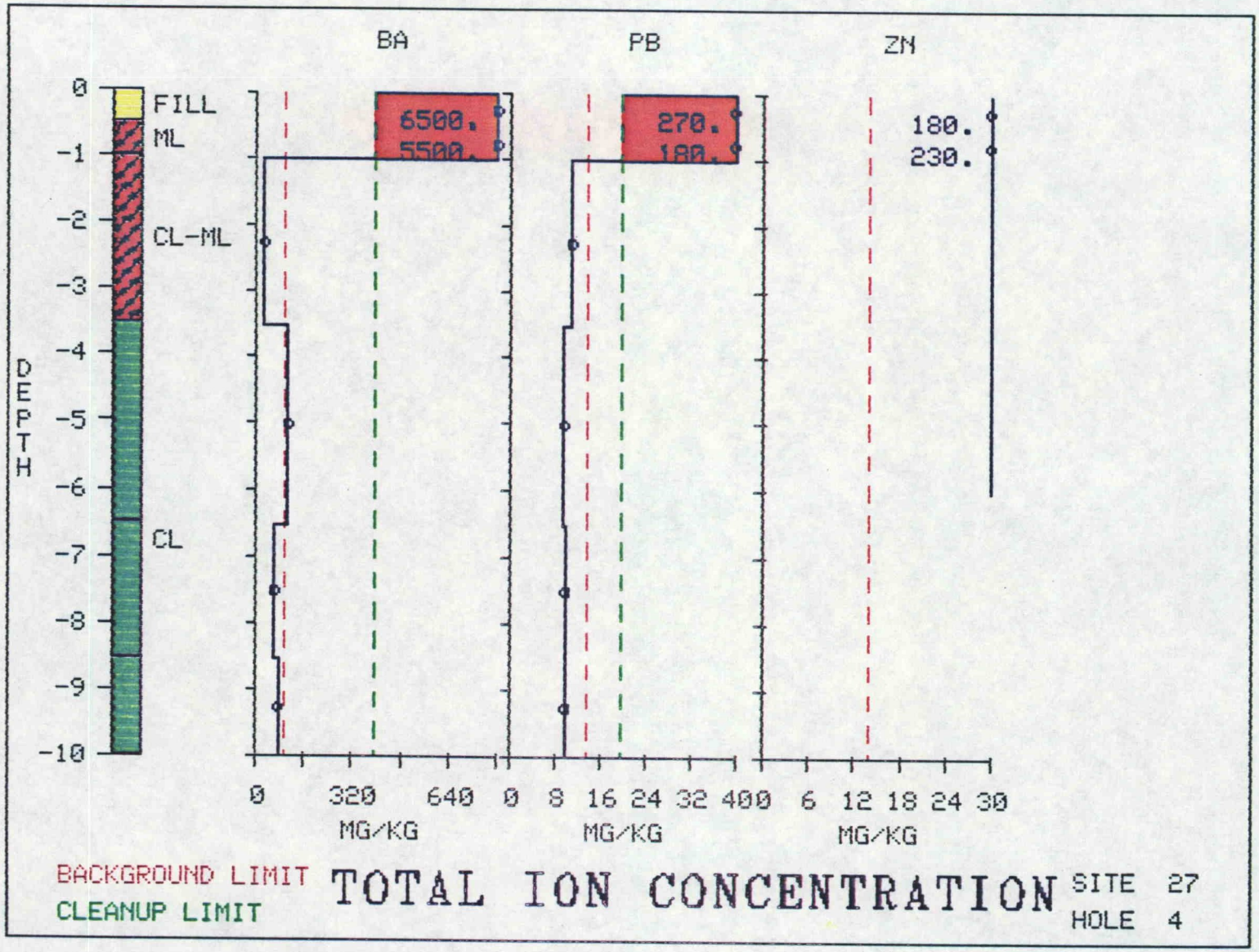
-2
-3
-4
-5
-6
-7
-8
-9
-10
DEPTH
FILL
CL-ML
2300.
1700.
65.
130.
0
320
640
0
8
16
24
32
400
6
12
18
24
30
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 2


BA
PB
ZN
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
DEPTH
FILL
CL-ML
970.
200.
50.
45.
0
320
640
MG/KG
0
8
16
24
32
400
MG/KG
6
12
18
24
30
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 3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-9
-10
DEPTH
FILL
ML
CL-ML
CL
6500.
5500.
270.
180.
180.
230.
0
320
640
0
8
16
24
32
400
6
12
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24
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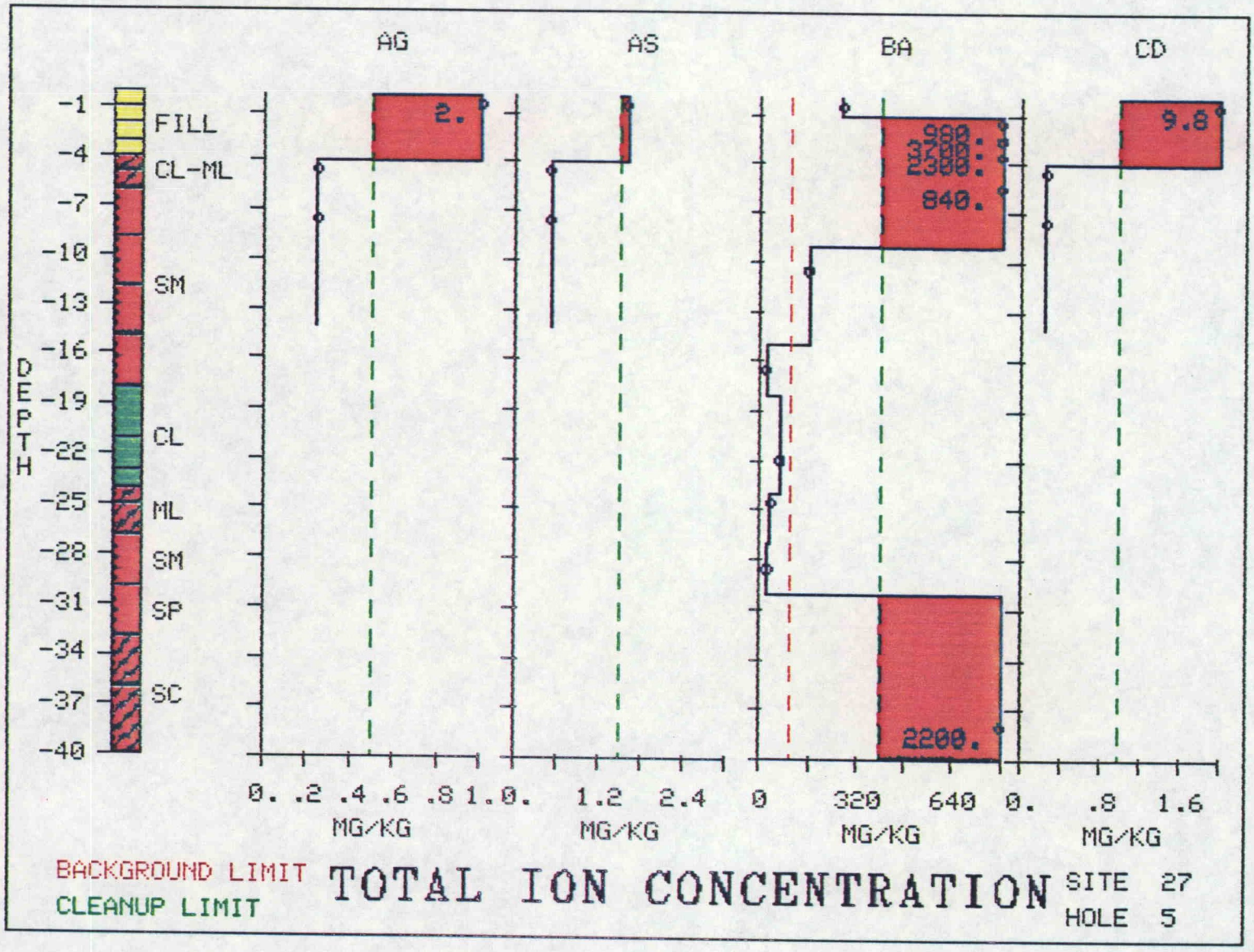
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 4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-25
-28
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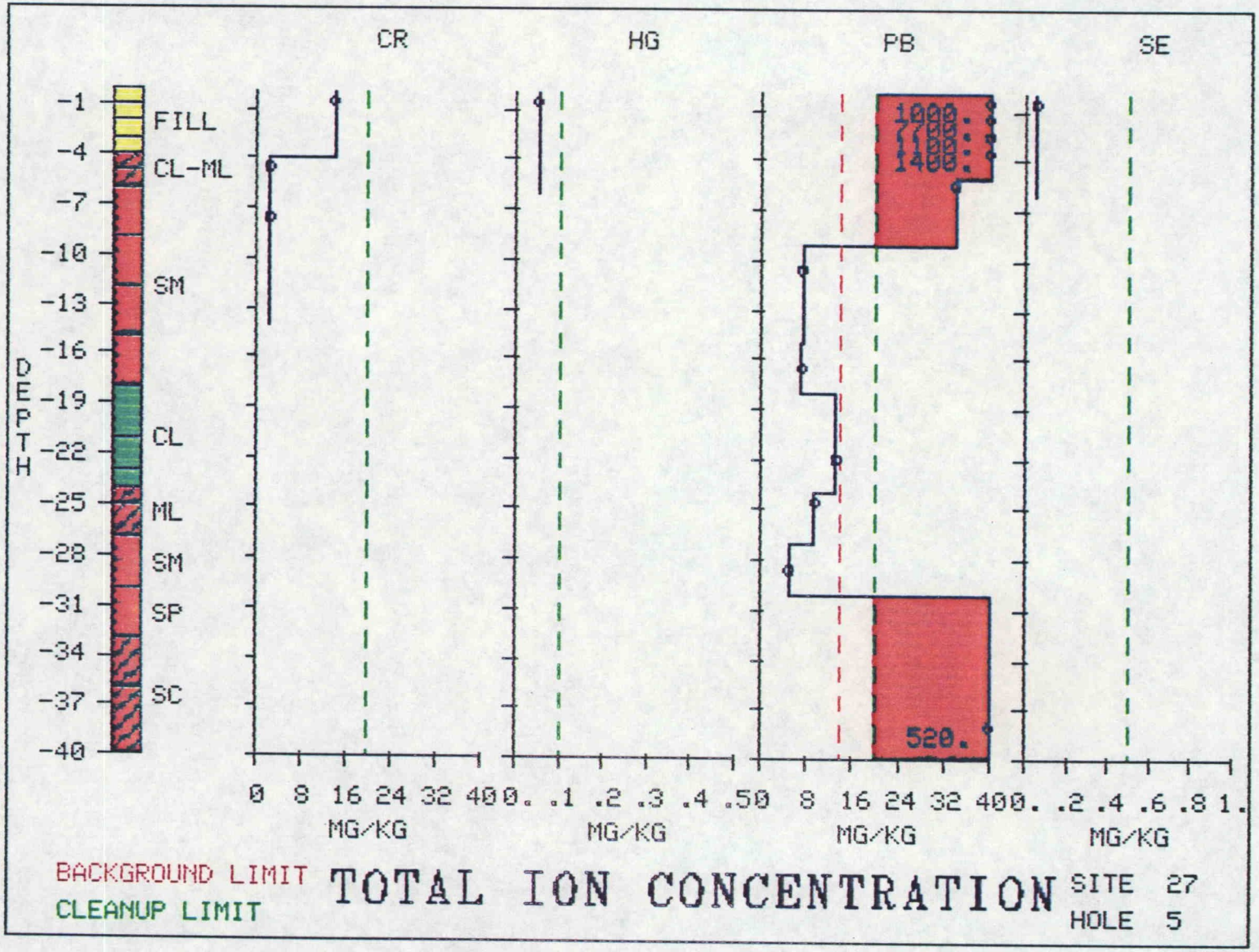
SM
CL
ML
SM
SP
SC
2.
9.8
960
3700
2300
840.
2200.
0. .2 .4 .6 .8 1.0.
1.2 2.4
0 320 640
0. .8 1.6
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 5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-40
FILL
CL-ML
SM
CL
ML
SM
SP
SC
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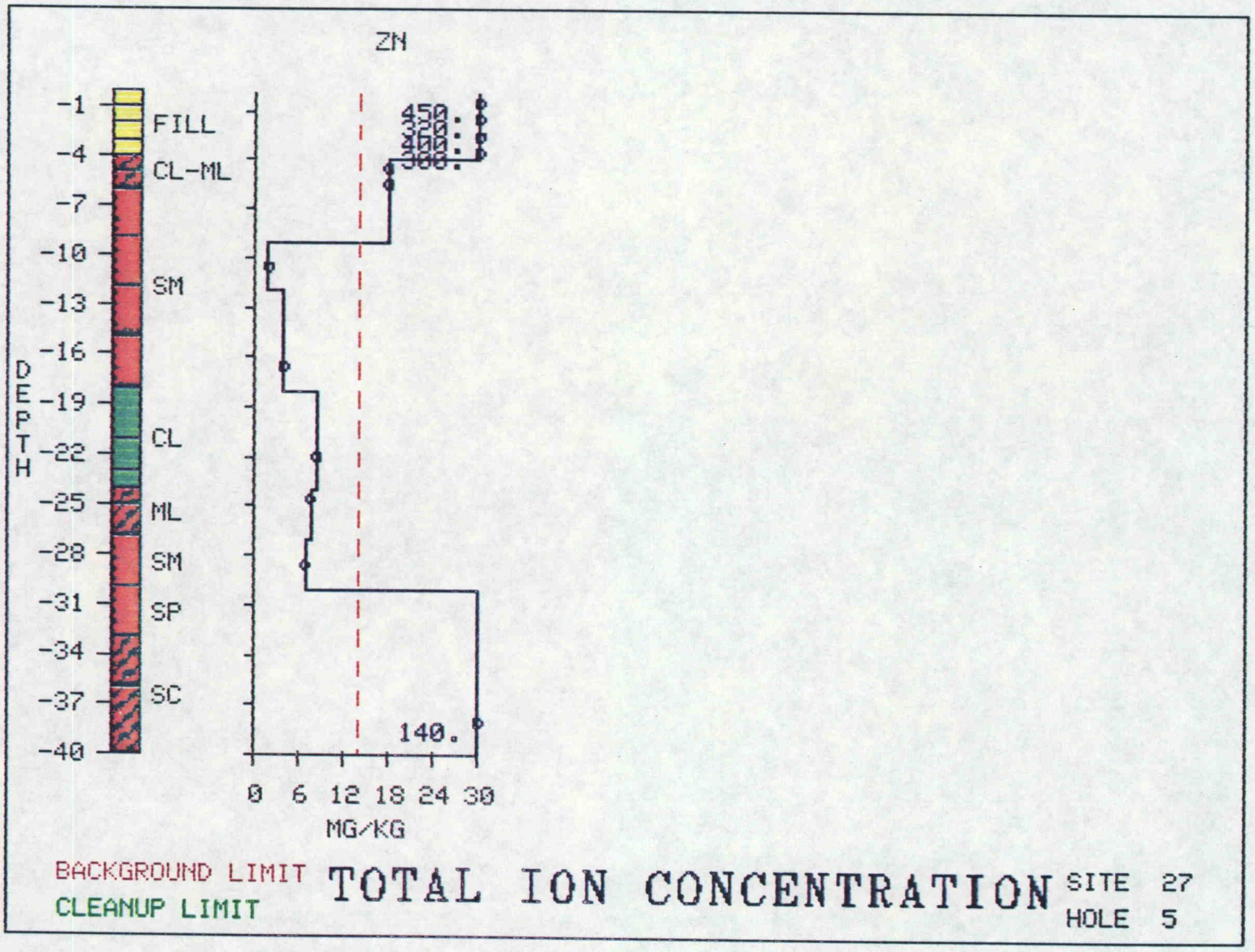
7700.
1100.
1400.
520.
0 8 16 24 32 400
0. .1 .2 .3 .4 .50
8 16 24 32 400
0. .2 .4 .6 .8 1.
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 5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FILL
CL-ML
SM
CL
ML
SM
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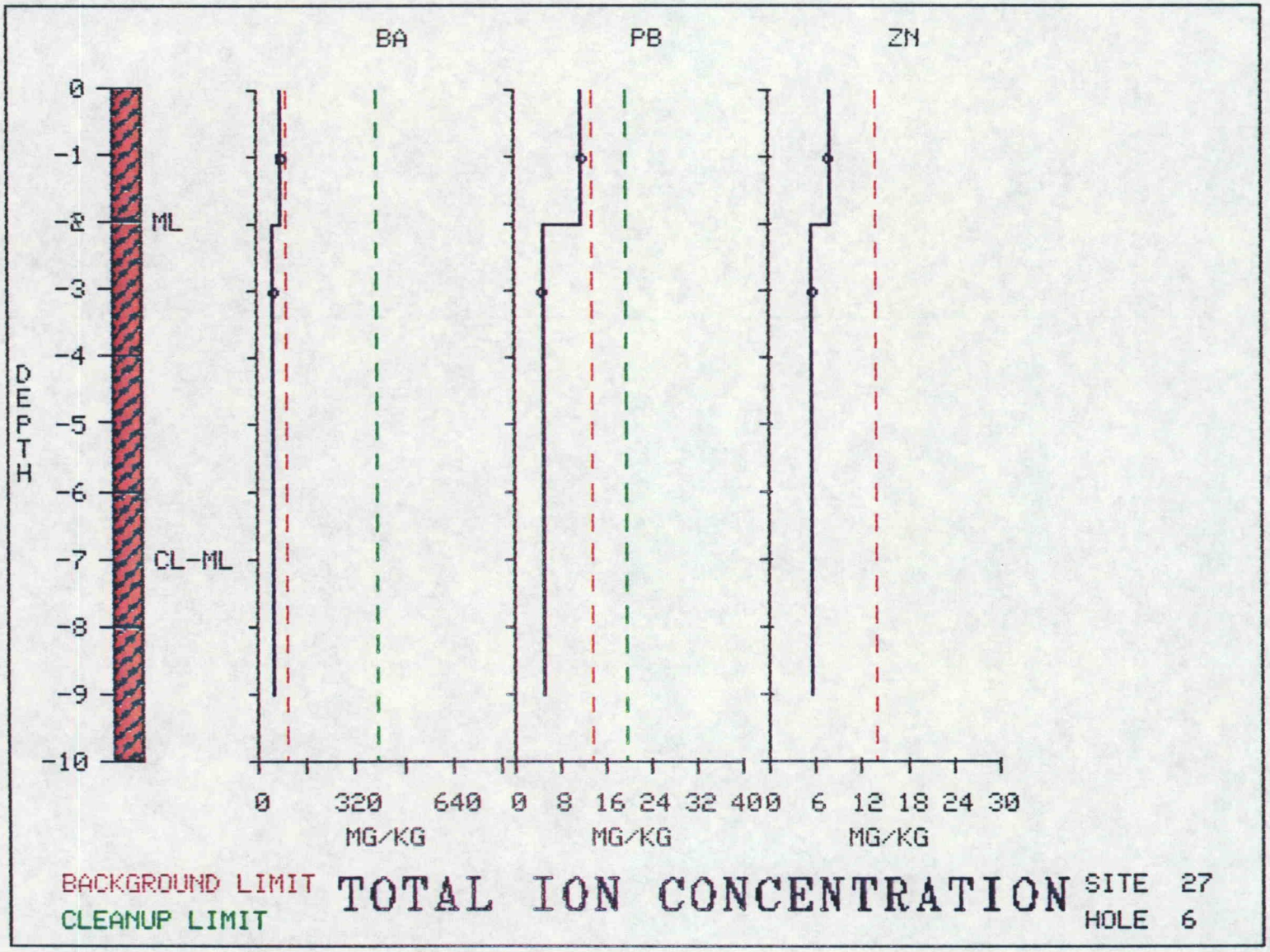
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 5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-9
-10
DEPTH
ML
CL-ML
0
320
640
0
8
16
24
32
400
6
12
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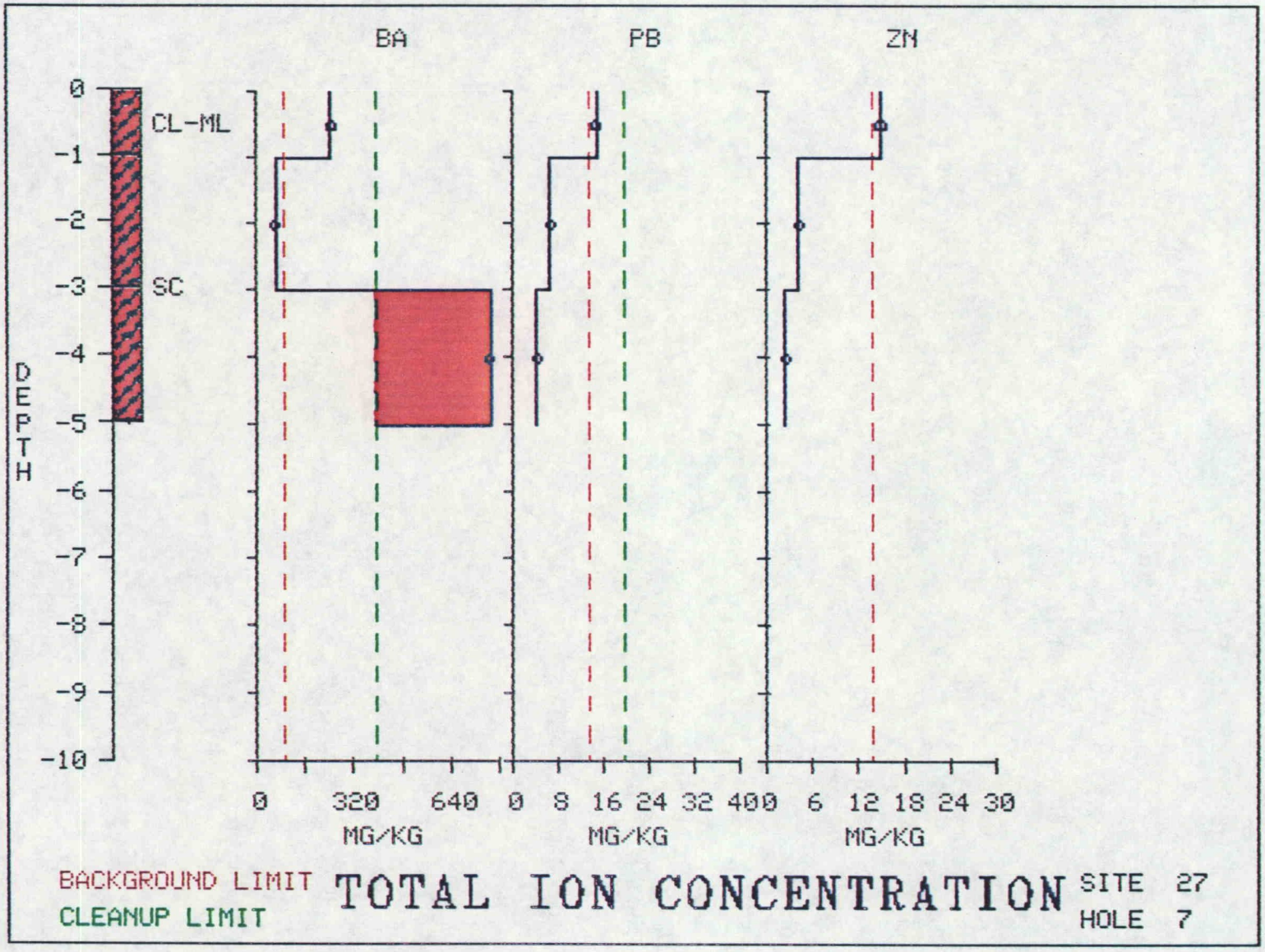
24
30
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 6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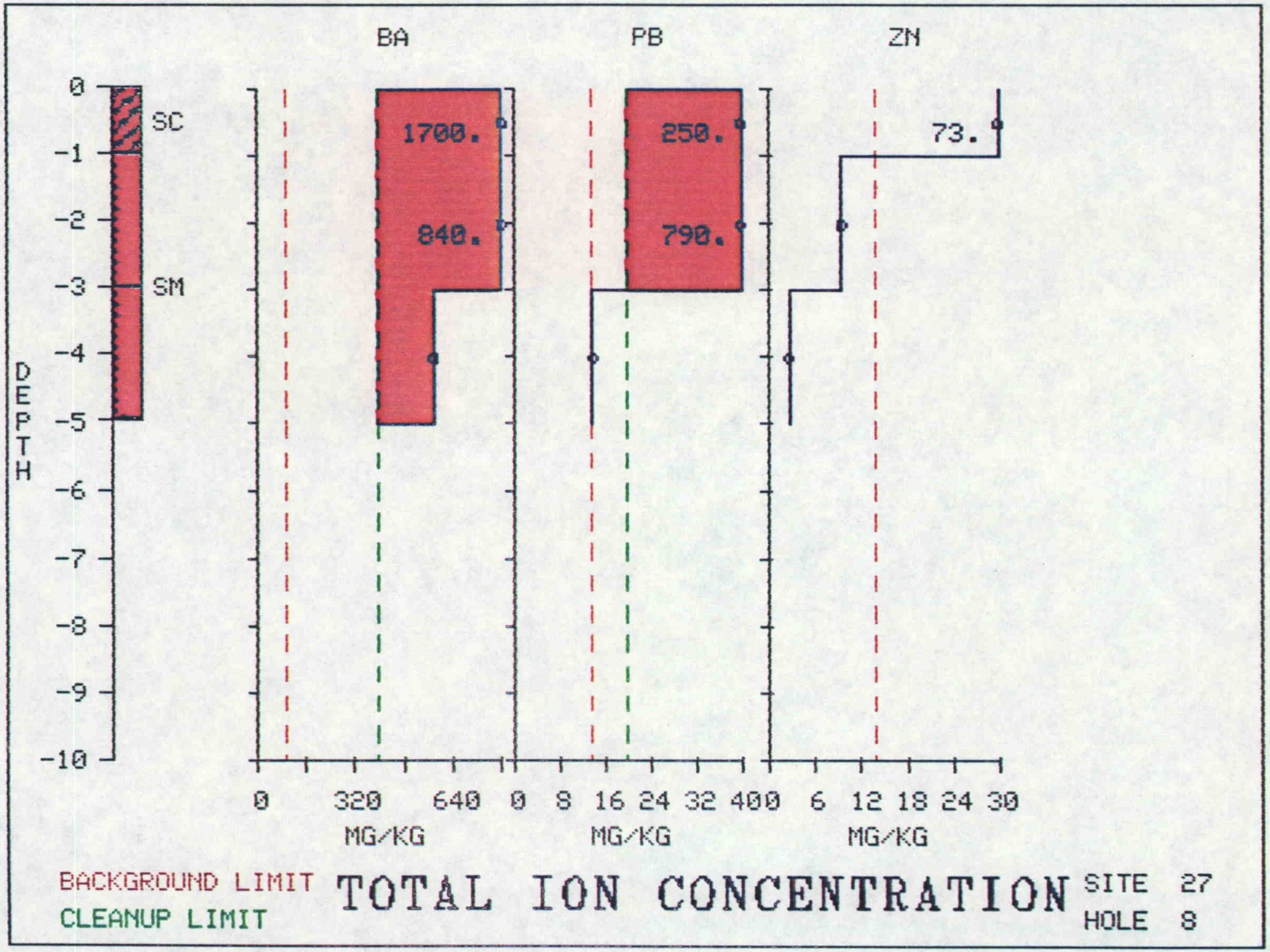
-10
DEPTH
CL-ML
SC
0 320 640
0 8 16 24 32 400
6 12 18 24 30
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 7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DEPTH
SC
SM
1700.
840.
250.
790.
73.
0
320
640
MG/KG
0
8
16
24
32
40
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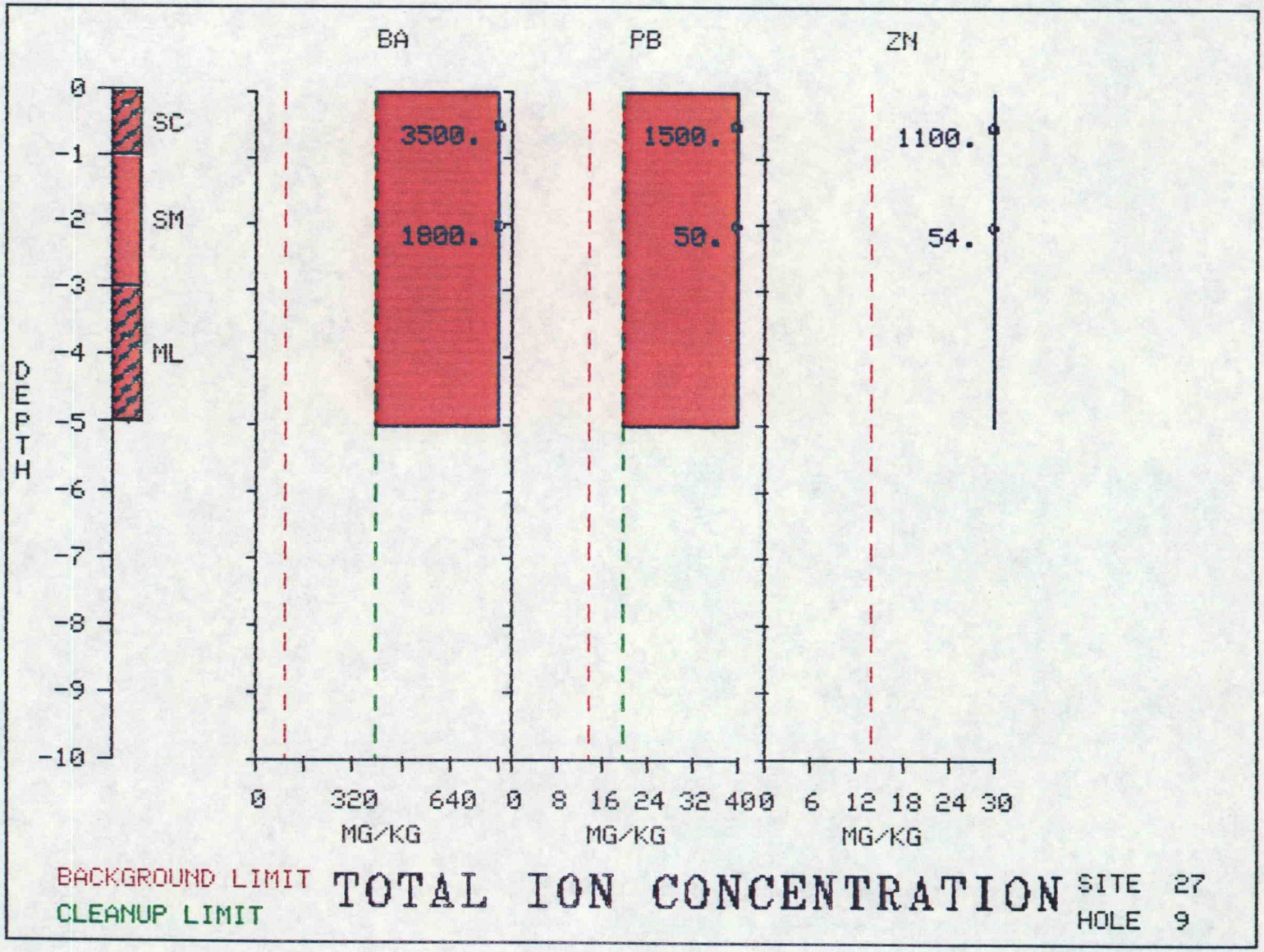
18
24
30
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 8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-5
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-7
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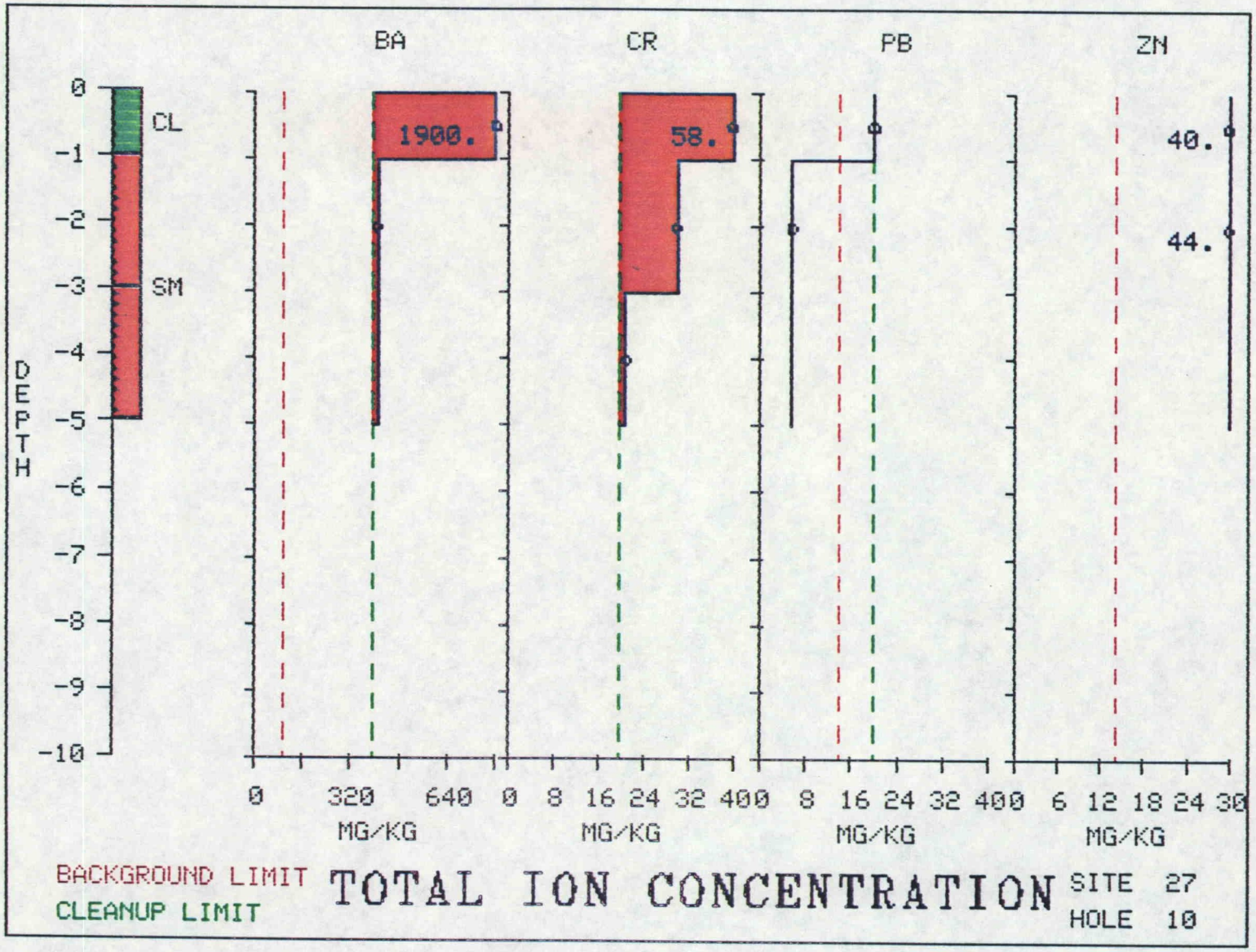
-9
-10
DEPTH
SC
SM
ML
3500.
1800.
1500.
50.
1100.
54.
0
320
640
0
8
16
24
32
400
6
12
18
24
30
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 9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-9
-10
DEPTH
CL
SM
1900.
58.
40.
44.
0
320
640
0
8
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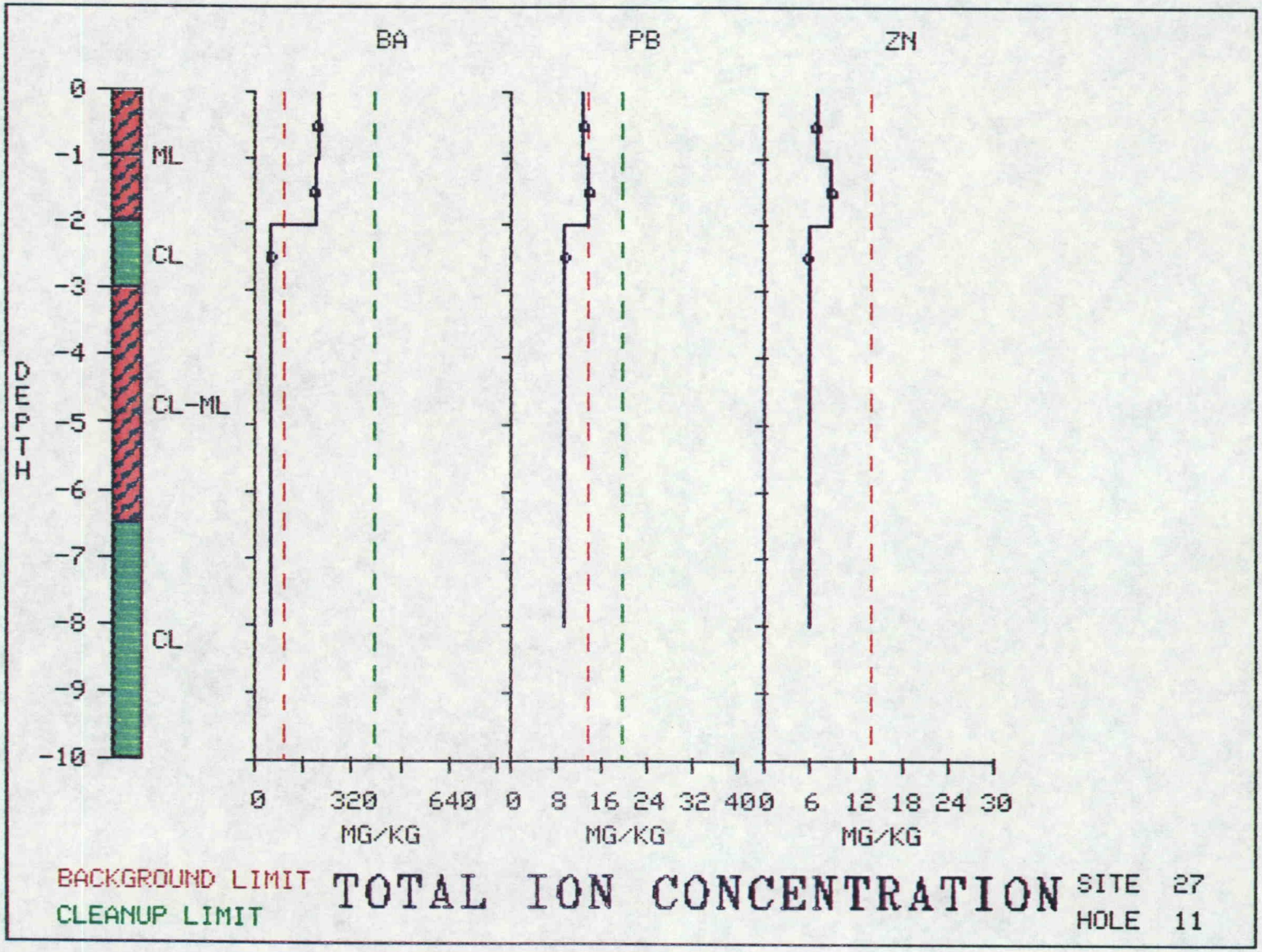
24
32
400
8
16
24
32
400
6
12
18
24
30
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 10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-7
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-9
-10
DEPTH
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320
640
MG/KG
0
8
16
24
32
400
MG/KG
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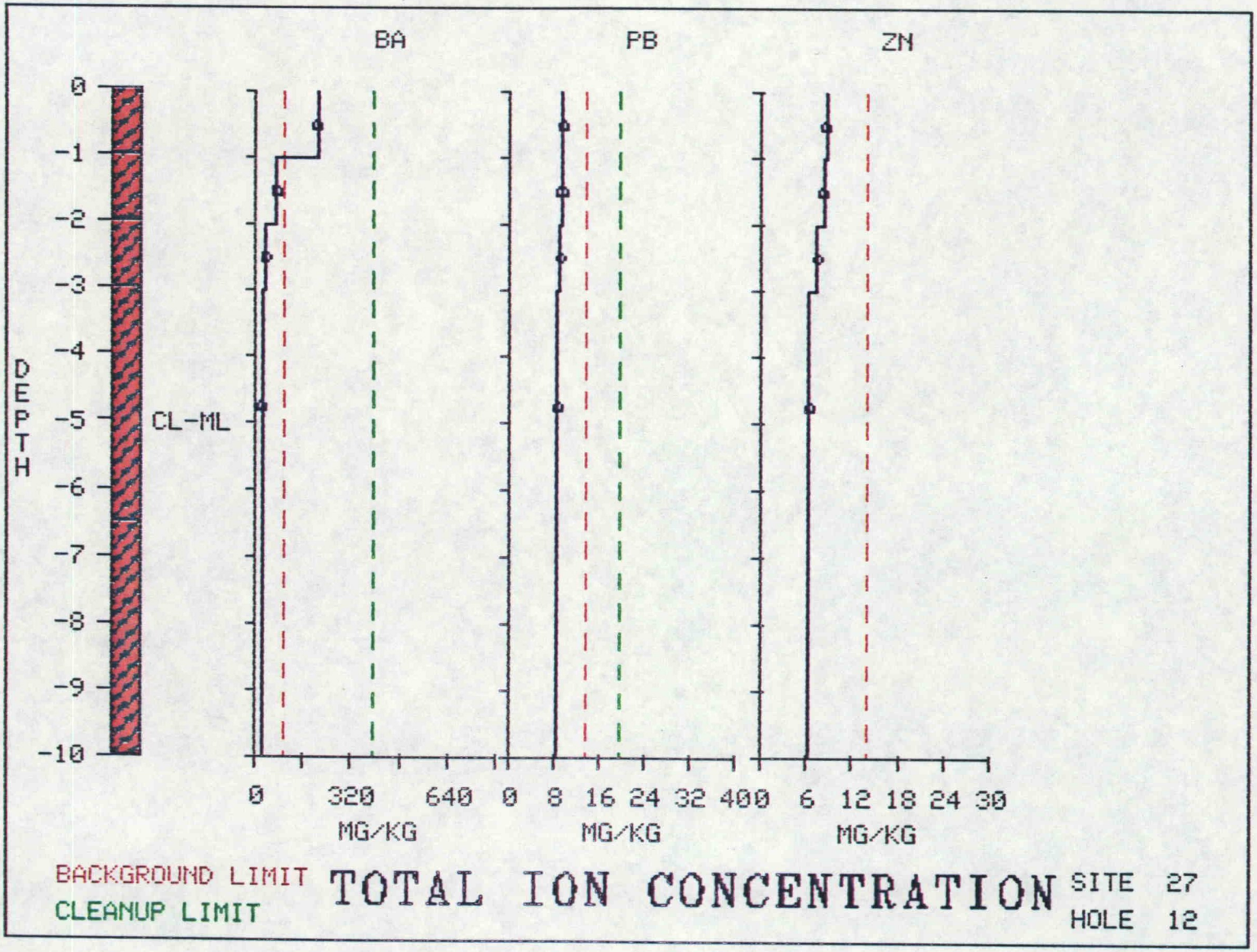
18
24
30
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 11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-9
-10
DEPTH
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320
640
MG/KG
0
8
16
24
32
400
MG/KG
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12
18
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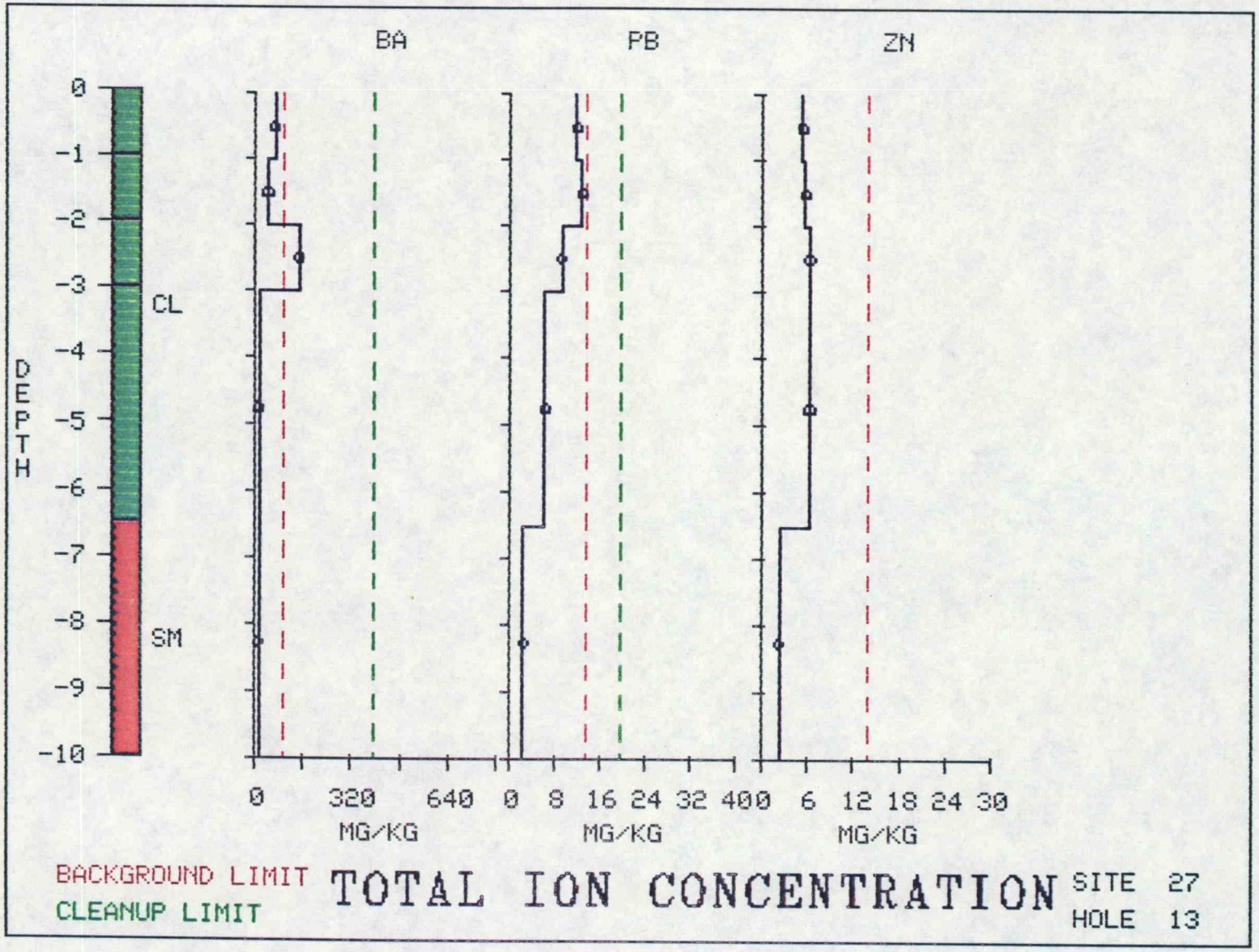
30
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 12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-10
DEPTH
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SM
0
320
640
MG/KG
0
8
16
24
32
400
MG/KG
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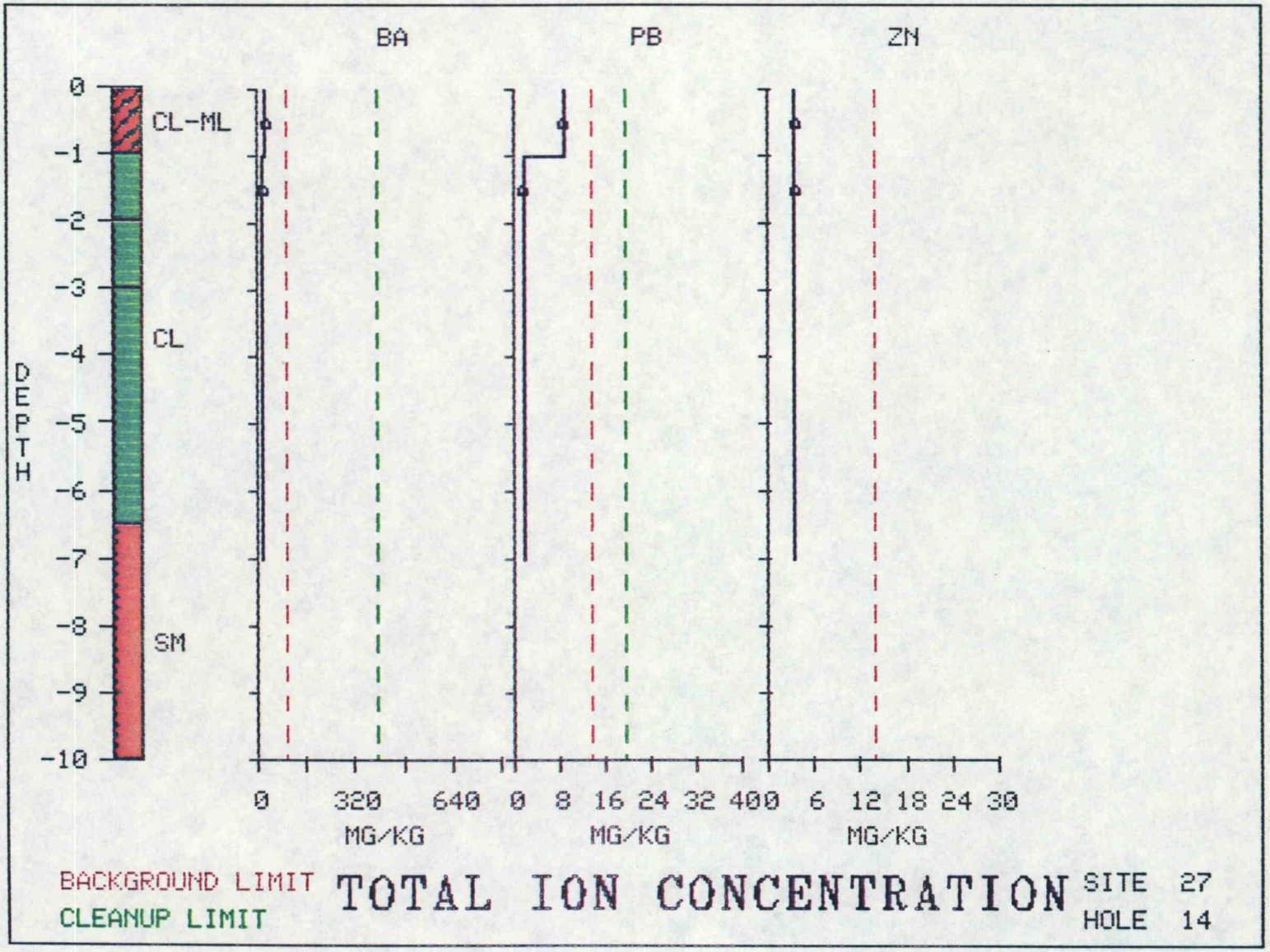
12
18
24
30
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 13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CL-ML
CL
SM
0
320
640
MG/KG
0
8
16
24
32
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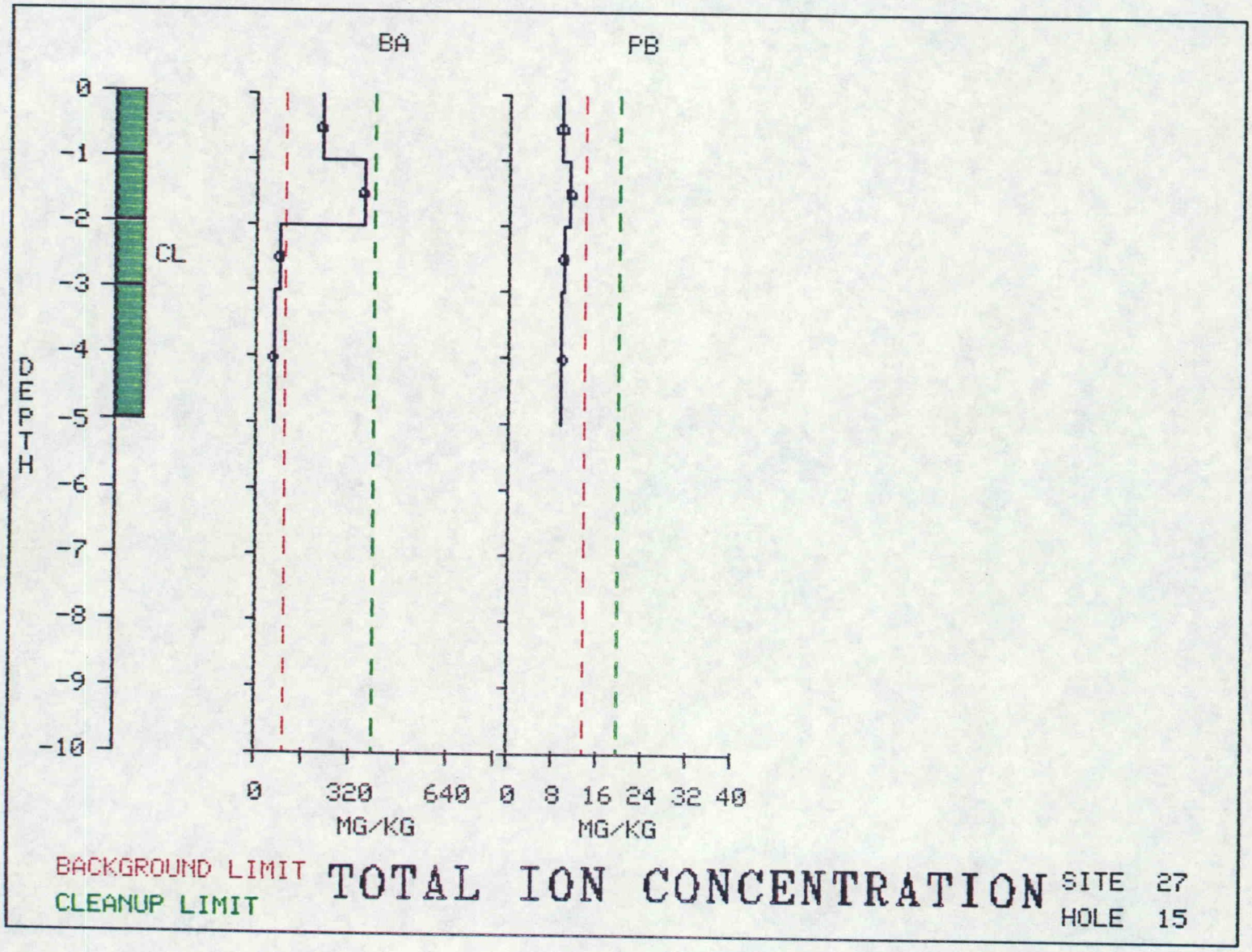
18
24
30
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 14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DEPTH
CL
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320
640
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16
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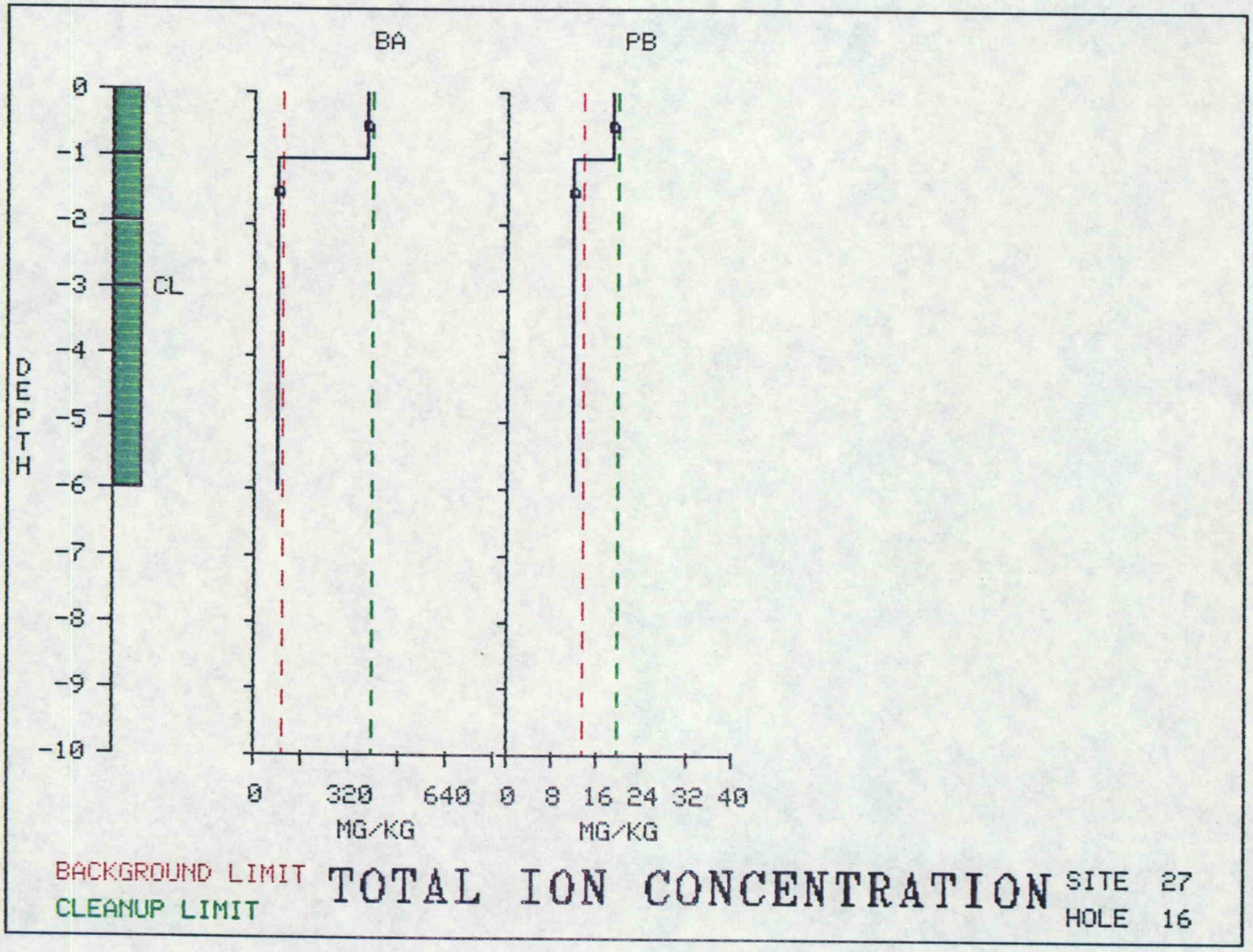
32
40
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 15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DEPTH
CL
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320
640
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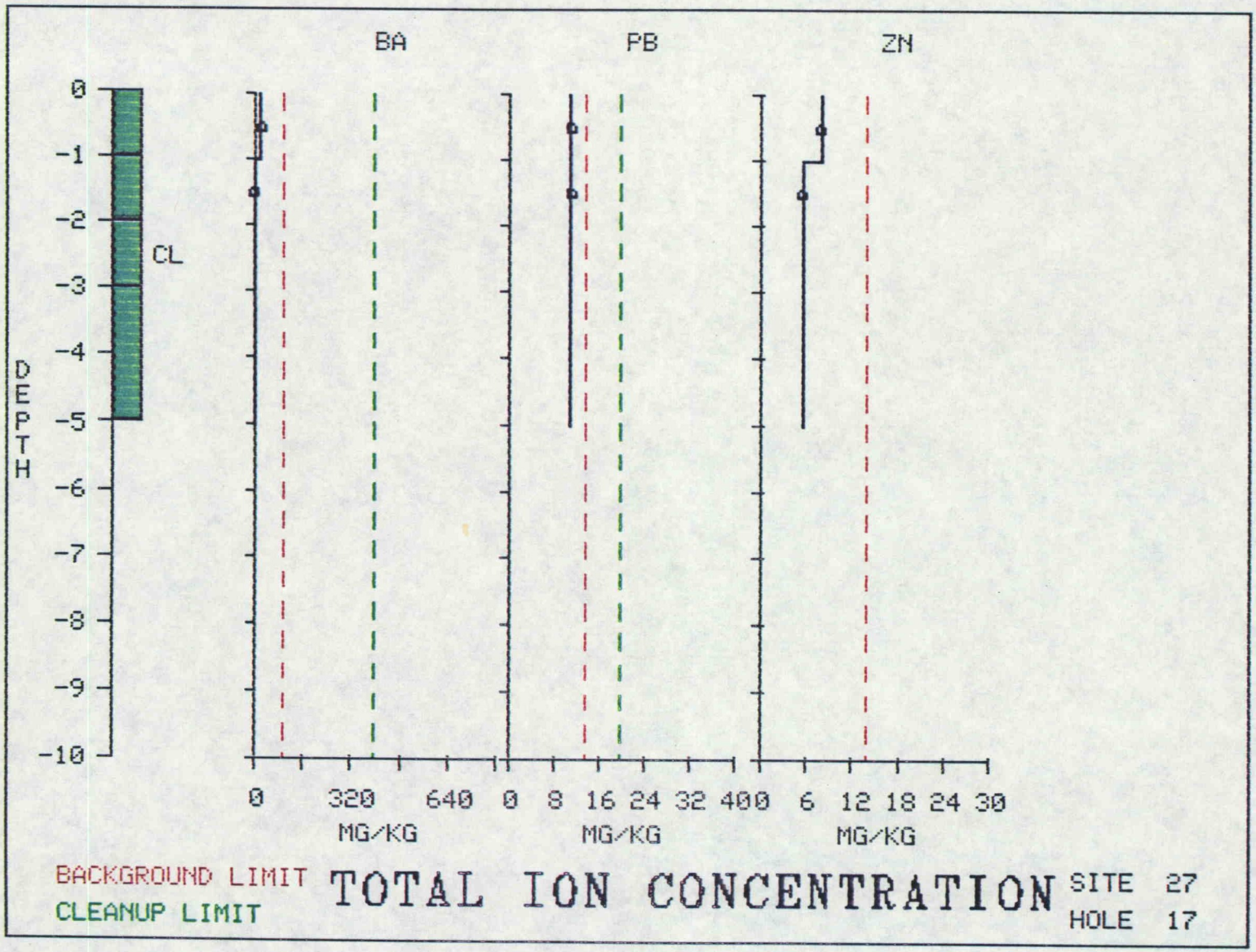
32
40
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 16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-9
-10
DEPTH
CL
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320
640
0
8
16
24
32
400
6
12
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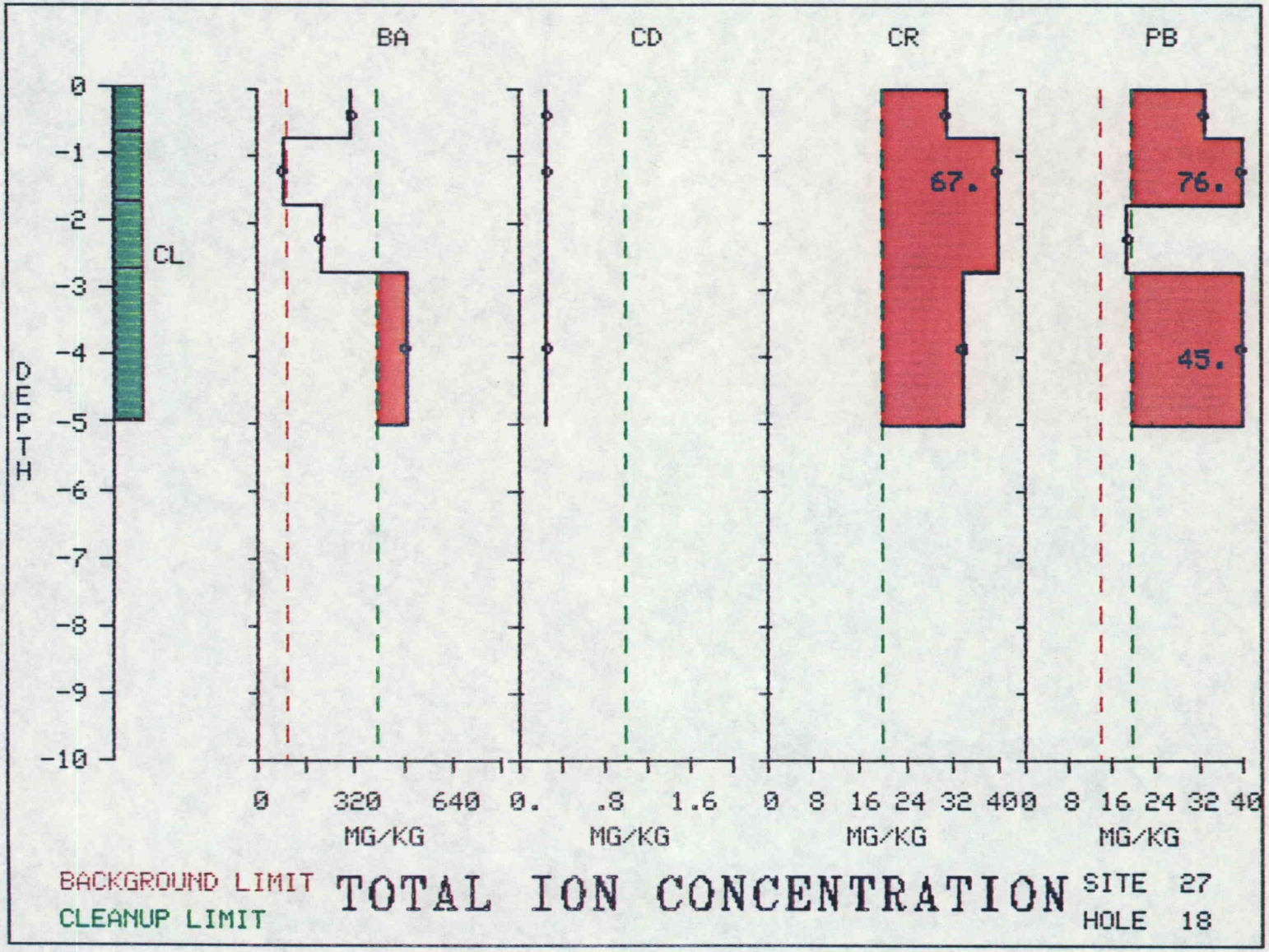
24
30
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 17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DEPTH
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-8
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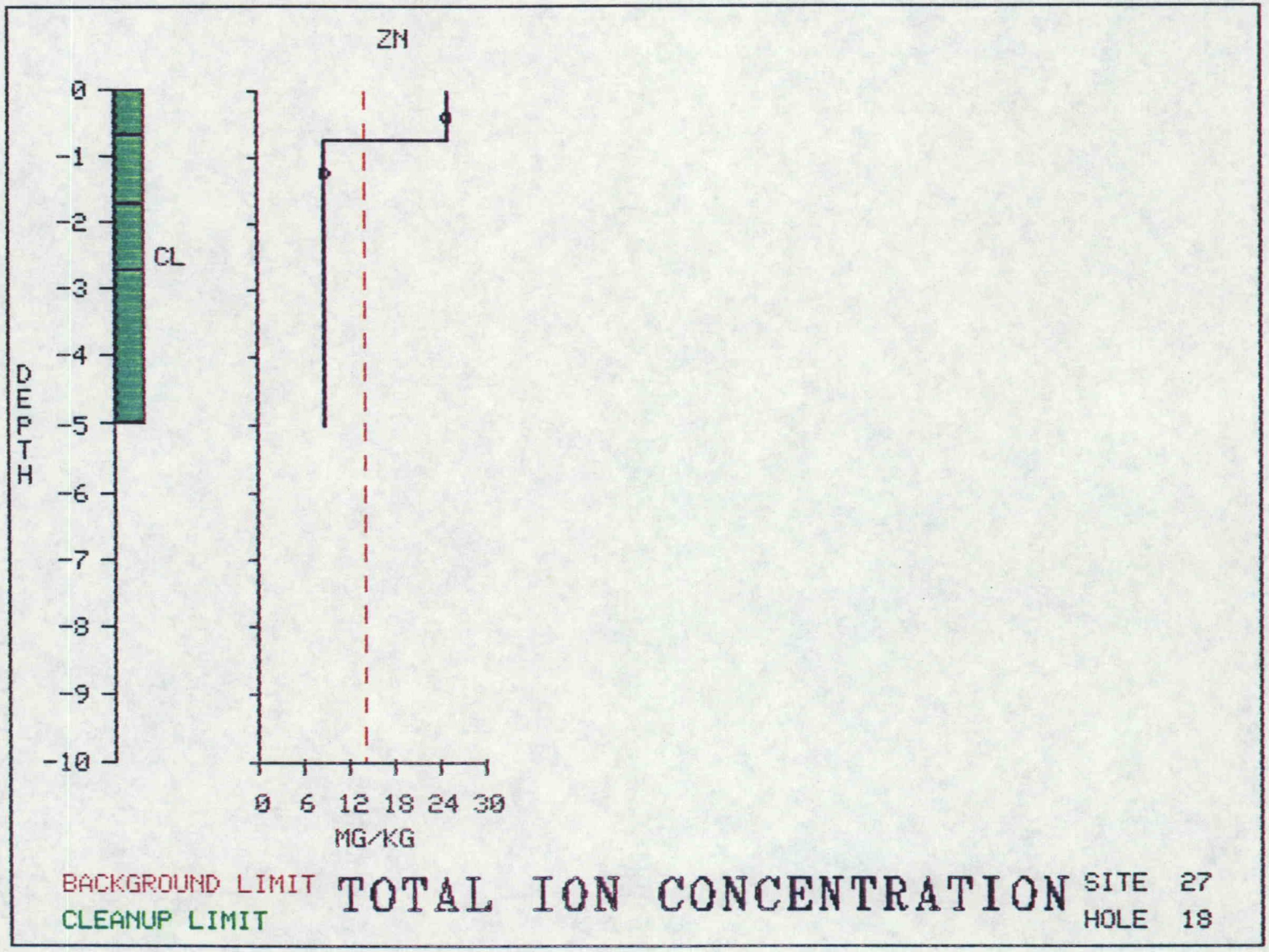
-10
CL
67.
76.
45.
0
320
640
0.
.8
1.6
0
8
16
24
32
400
8
16
24
32
40
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 18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-6
-7
-8
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DEPTH
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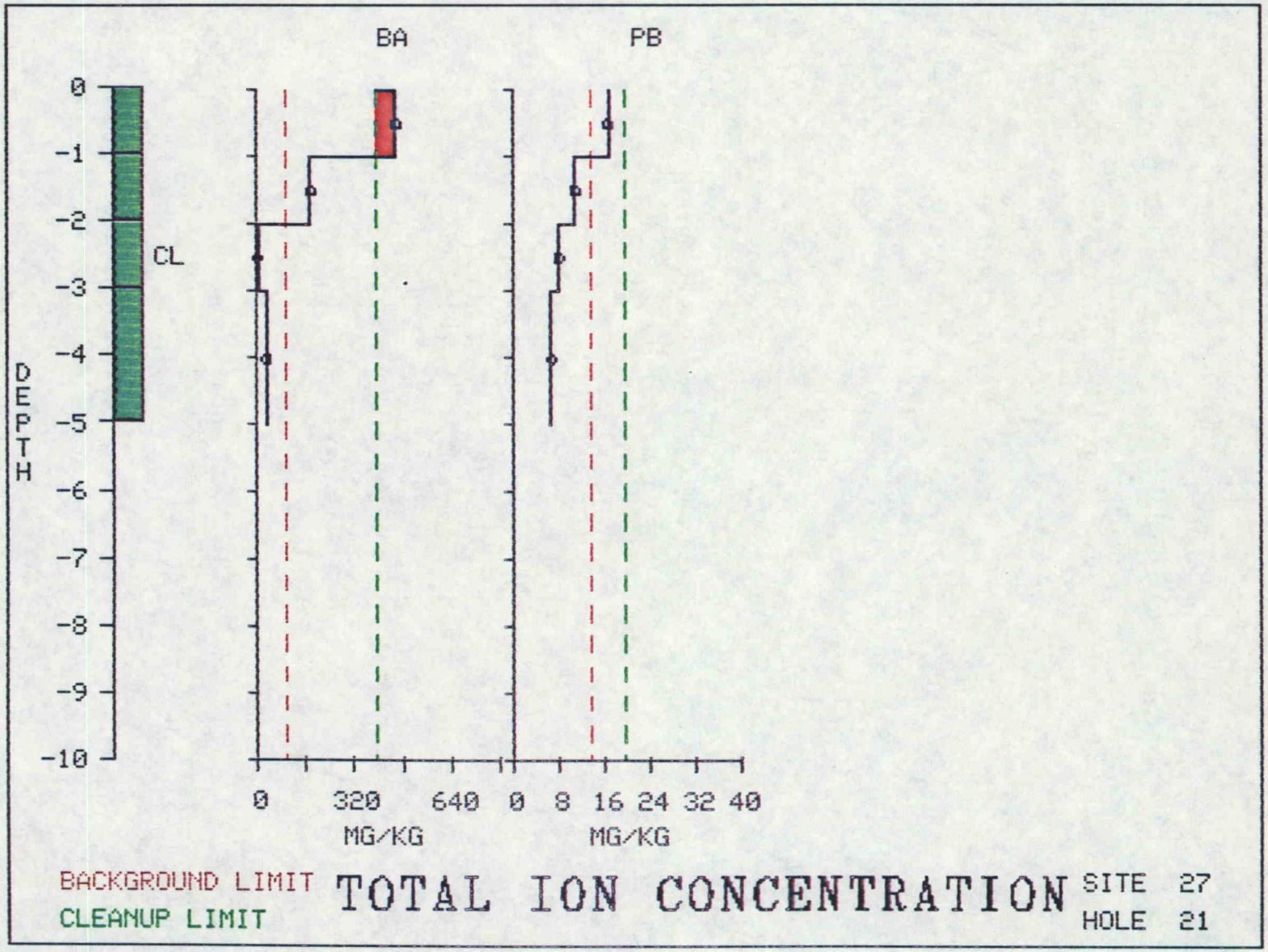
0 6 12 18 24 30
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 18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PB
0
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-2
-3
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-10
DEPTH
CL
0
320
640
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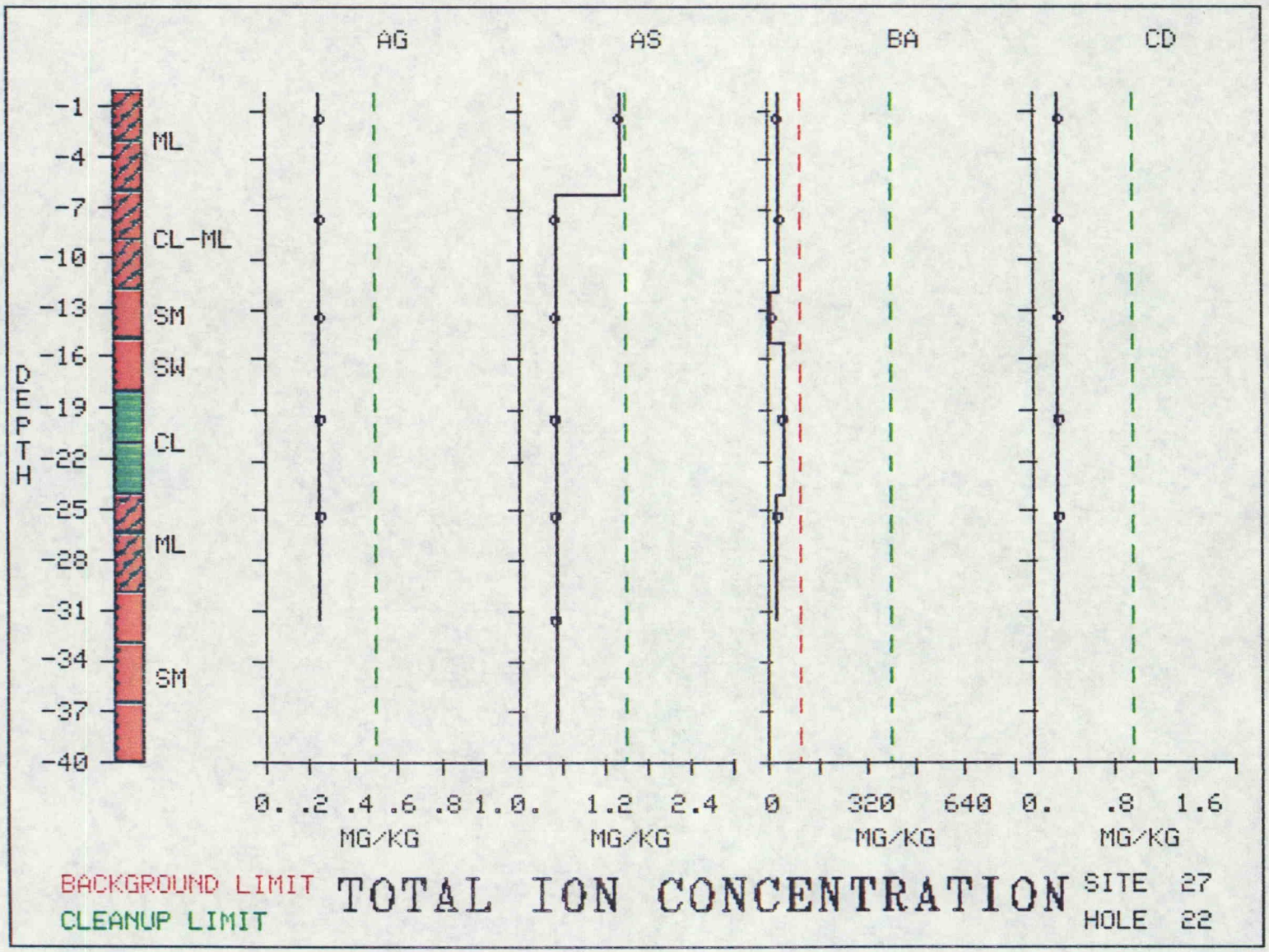
16
24
32
40
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 21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CD
DEPTH
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-4
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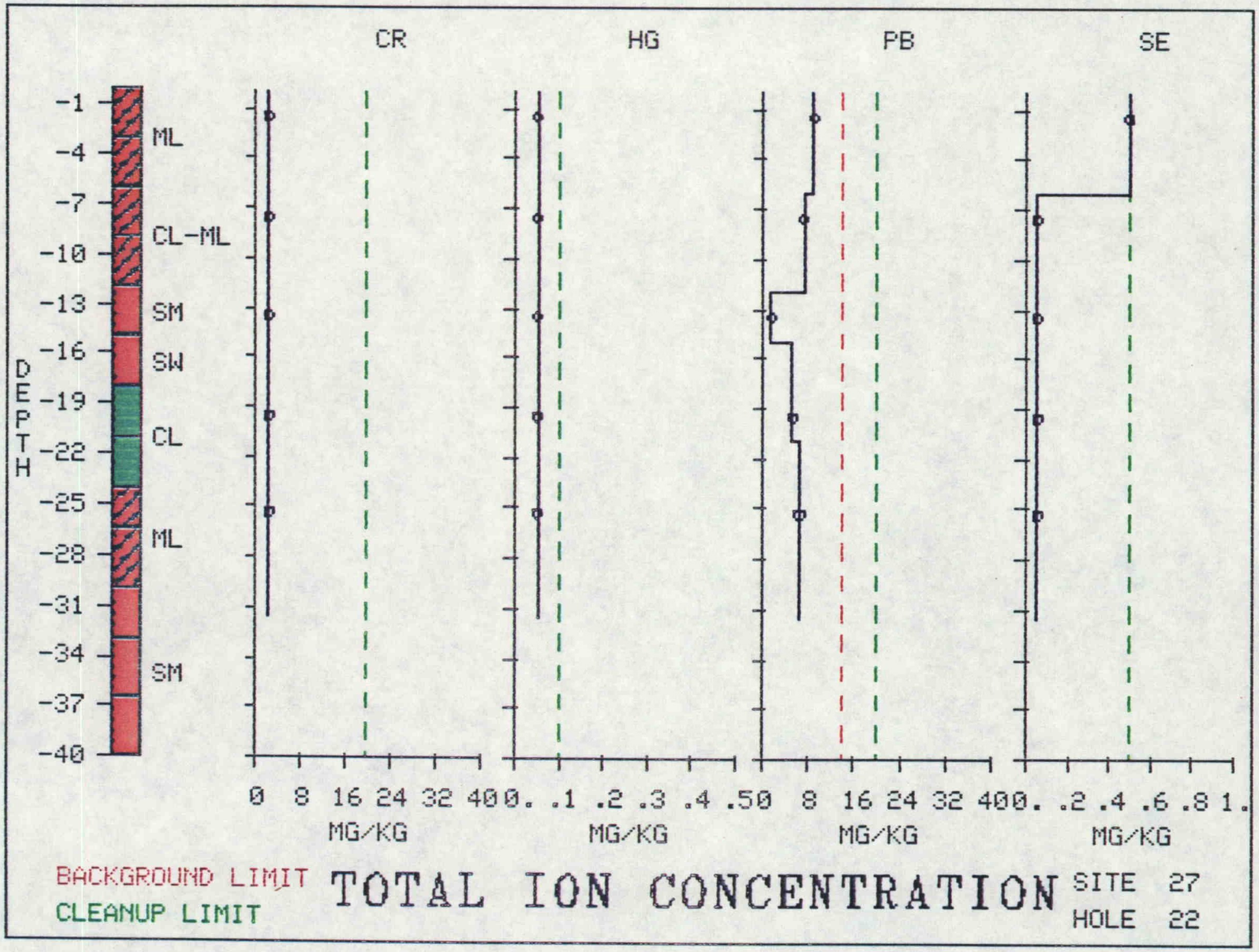
-10
-13
-16
-19
-22
-25
-28
-31
-34
-37
-40
ML
CL-ML
SM
SW
CL
ML
SM
0. .2 .4 .6 .8 1.0.
1.2 2.4
0 320 640
0. .8 1.6
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 22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PB
SE
DEPTH
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-22
-25
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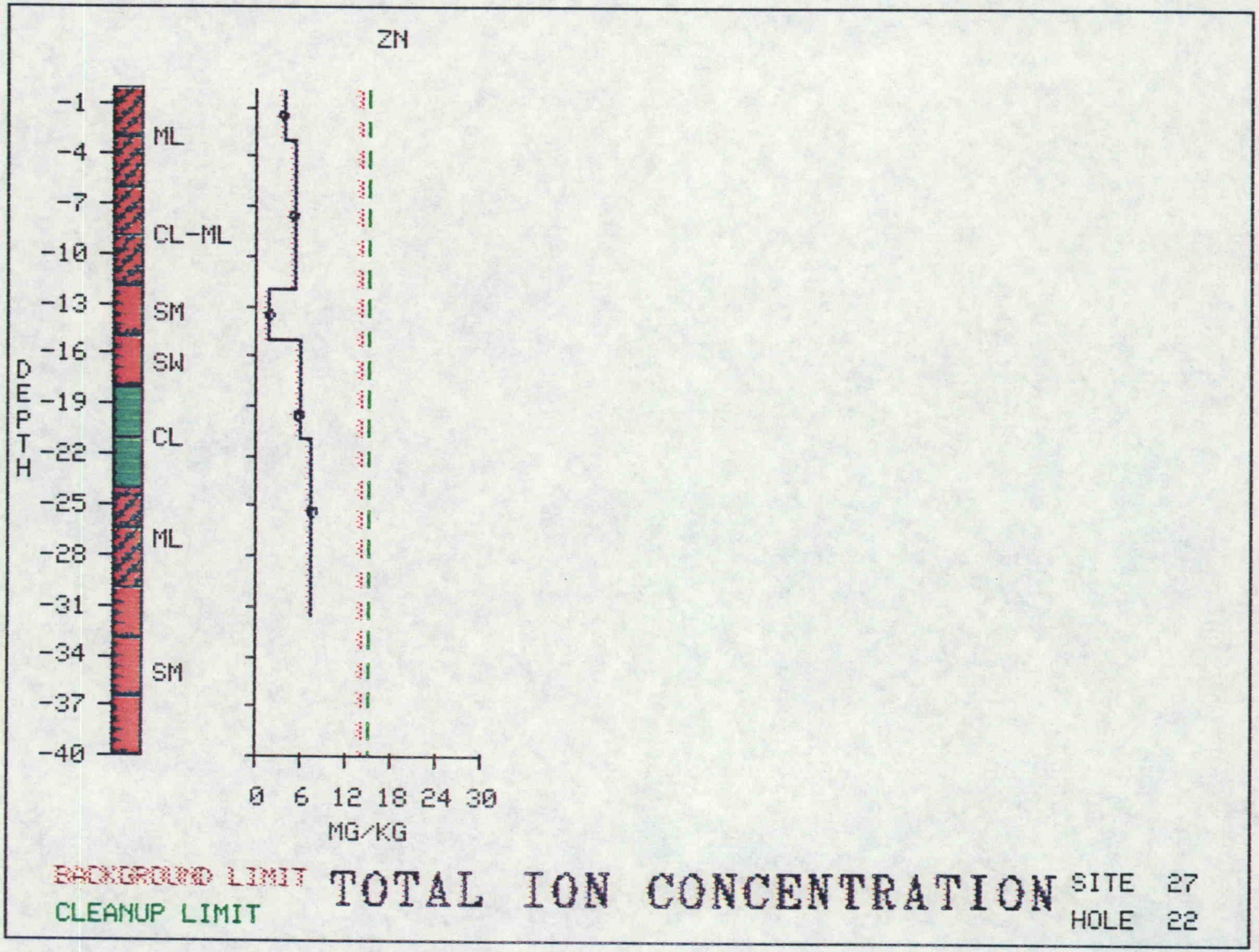
-31
-34
-37
-40
ML
CL-ML
SM
SW
CL
ML
SM
0 8 16 24 32 40
0. .1 .2 .3 .4 .5
0 8 16 24 32 40
0. .2 .4 .6 .8 1.
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 22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DEPTH
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-31
-34
-37
-40
ML
CL-ML
SM
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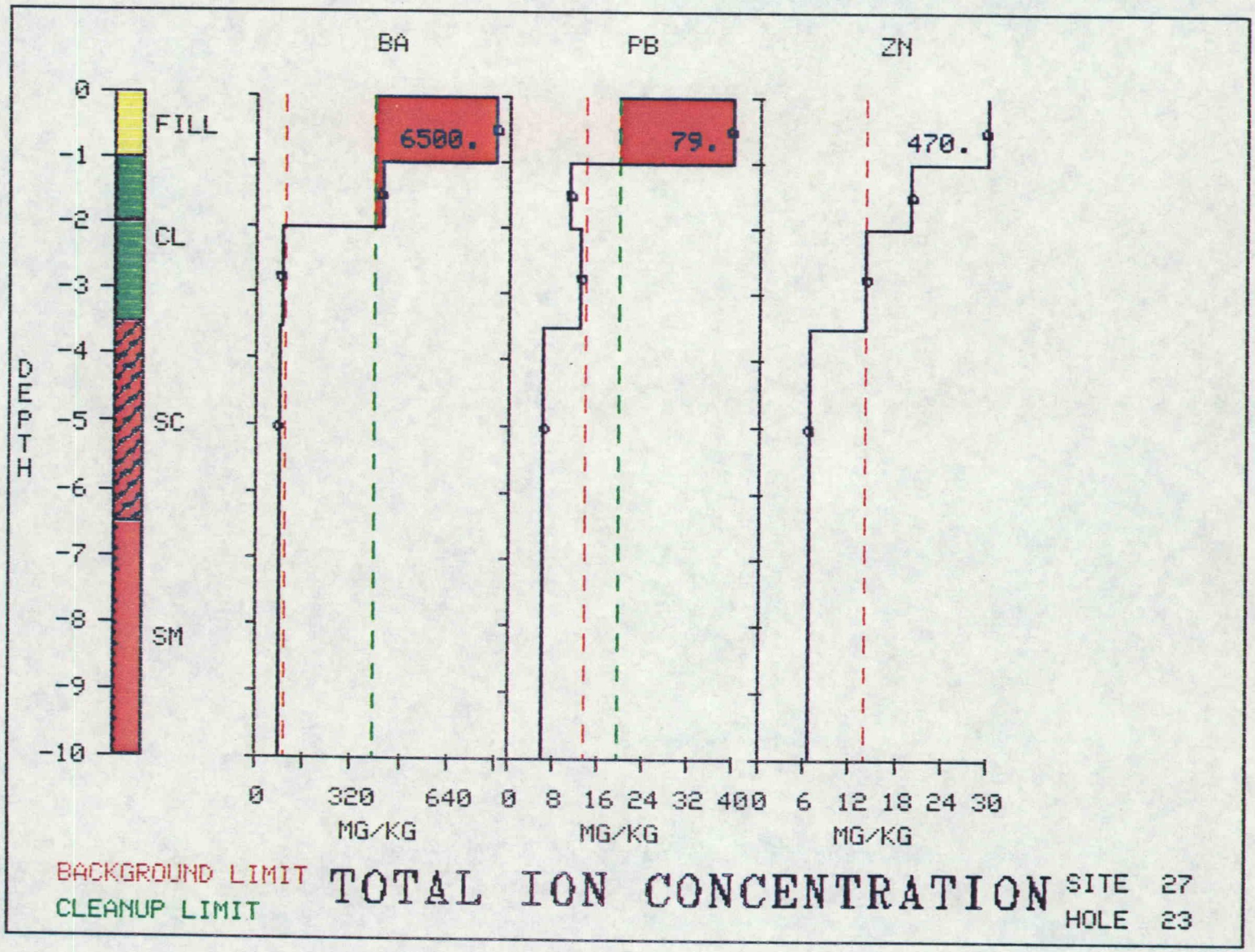
CL
ML
SM
0 6 12 18 24 30
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 22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PB
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DEPTH
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-4
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-6
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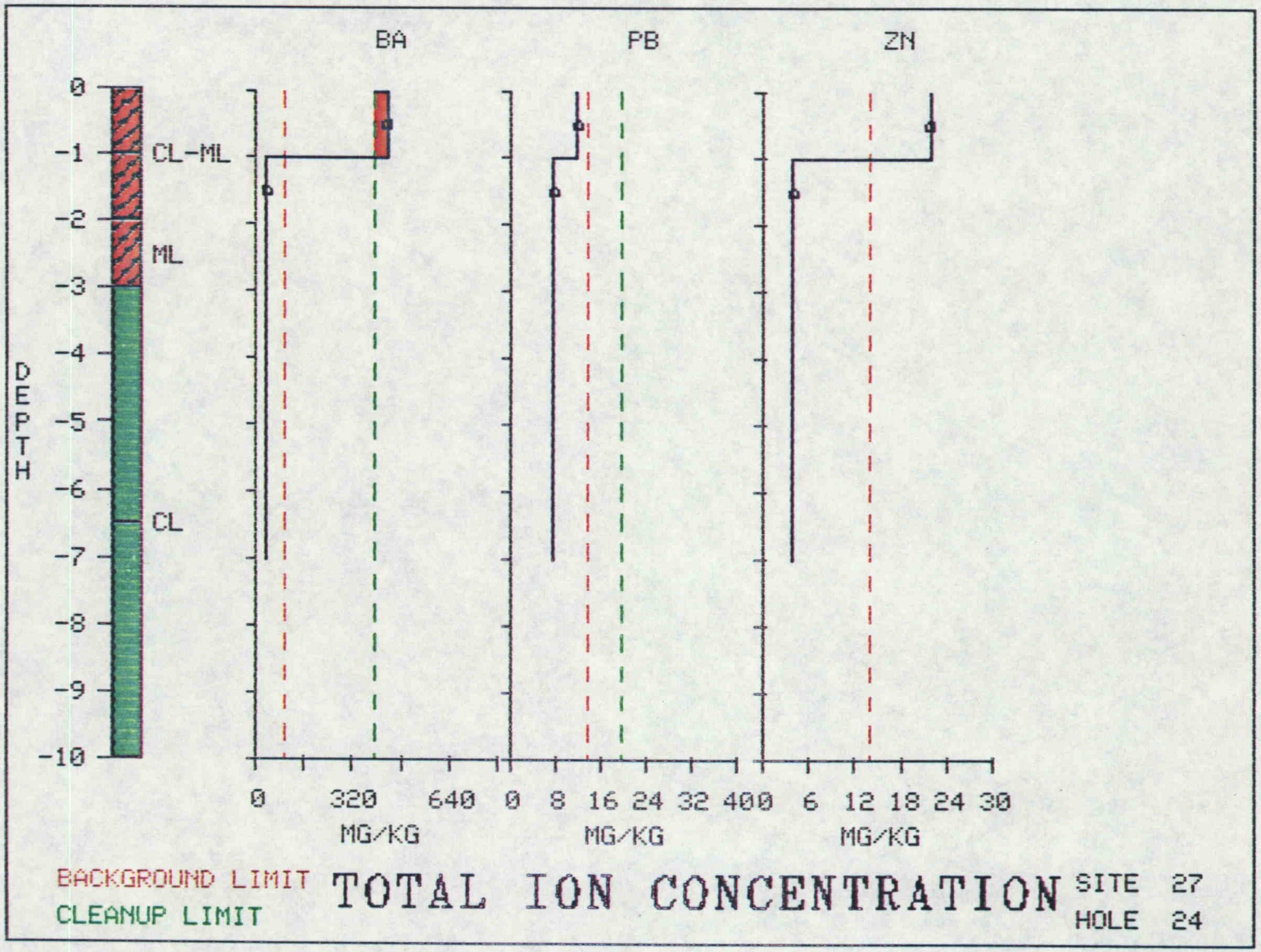
-8
-9
-10
FILL
CL
SC
SM
6500.
79.
470.
0
320
640
0
8
16
24
32
400
6
12
18
24
30
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 23


BA
PB
ZN
DEPTH
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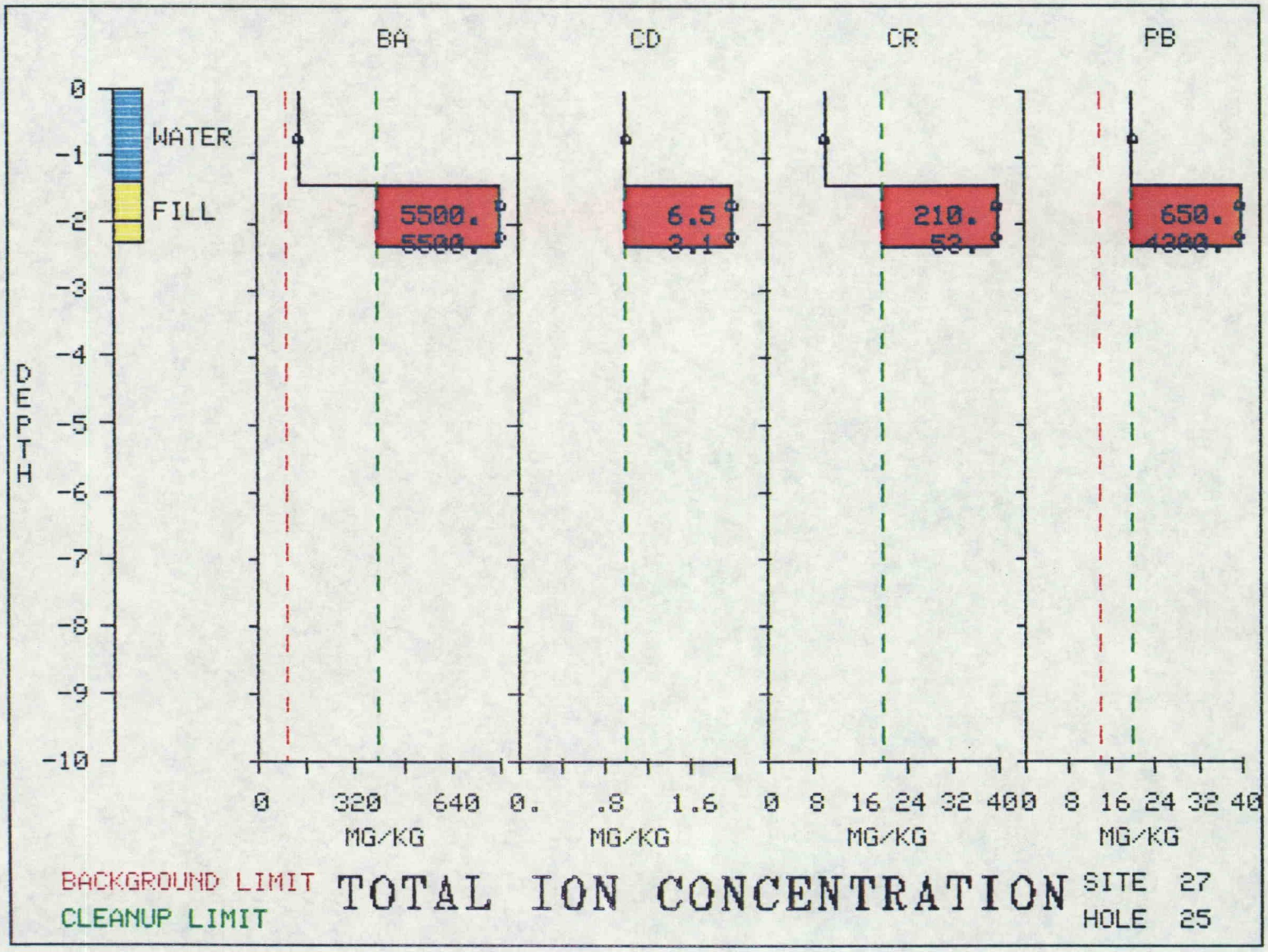
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
CL-ML
ML
CL
0 320 640
0 8 16 24 32 400
6 12 18 24 30
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 24


BA
CD
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PB
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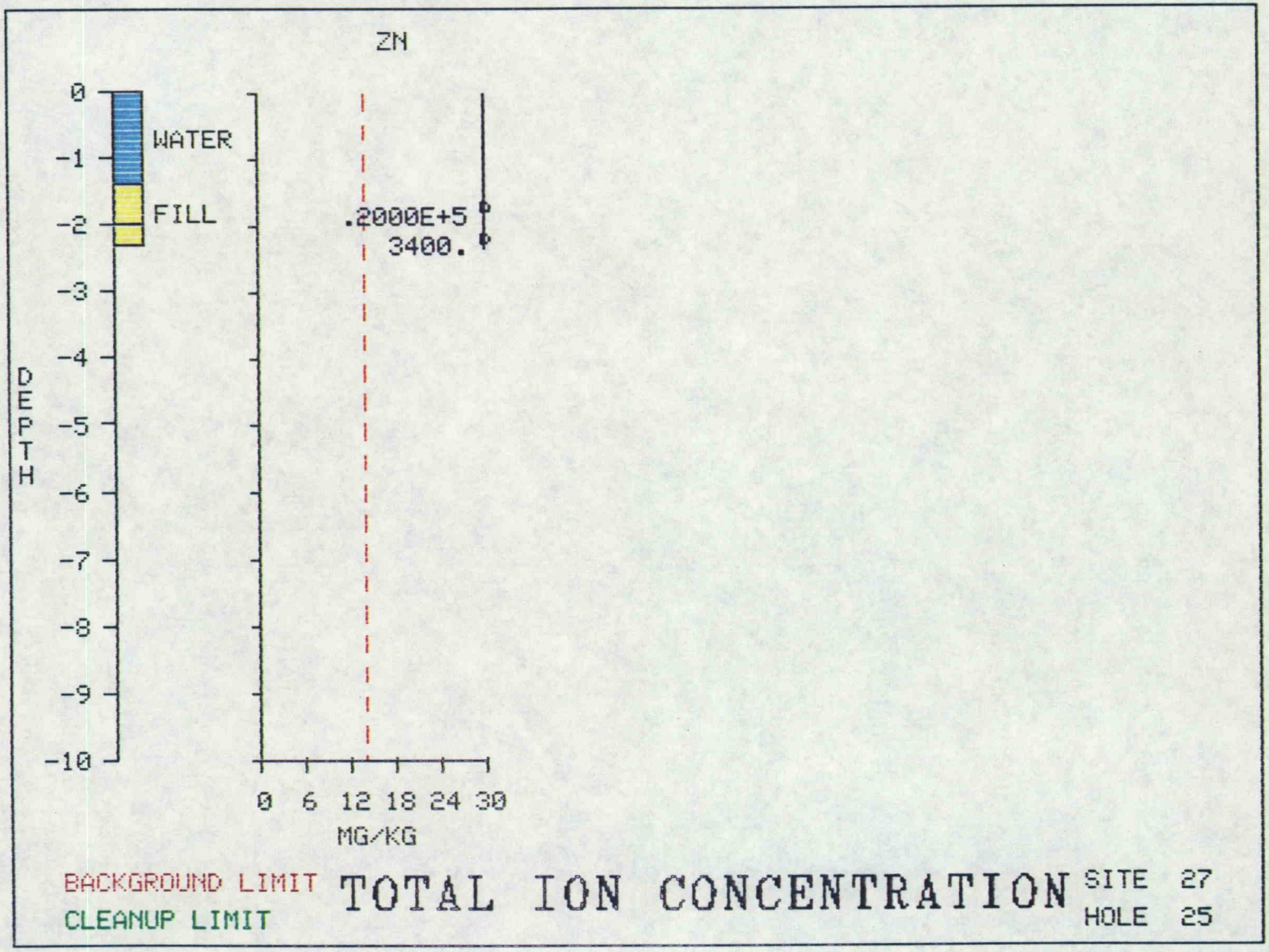
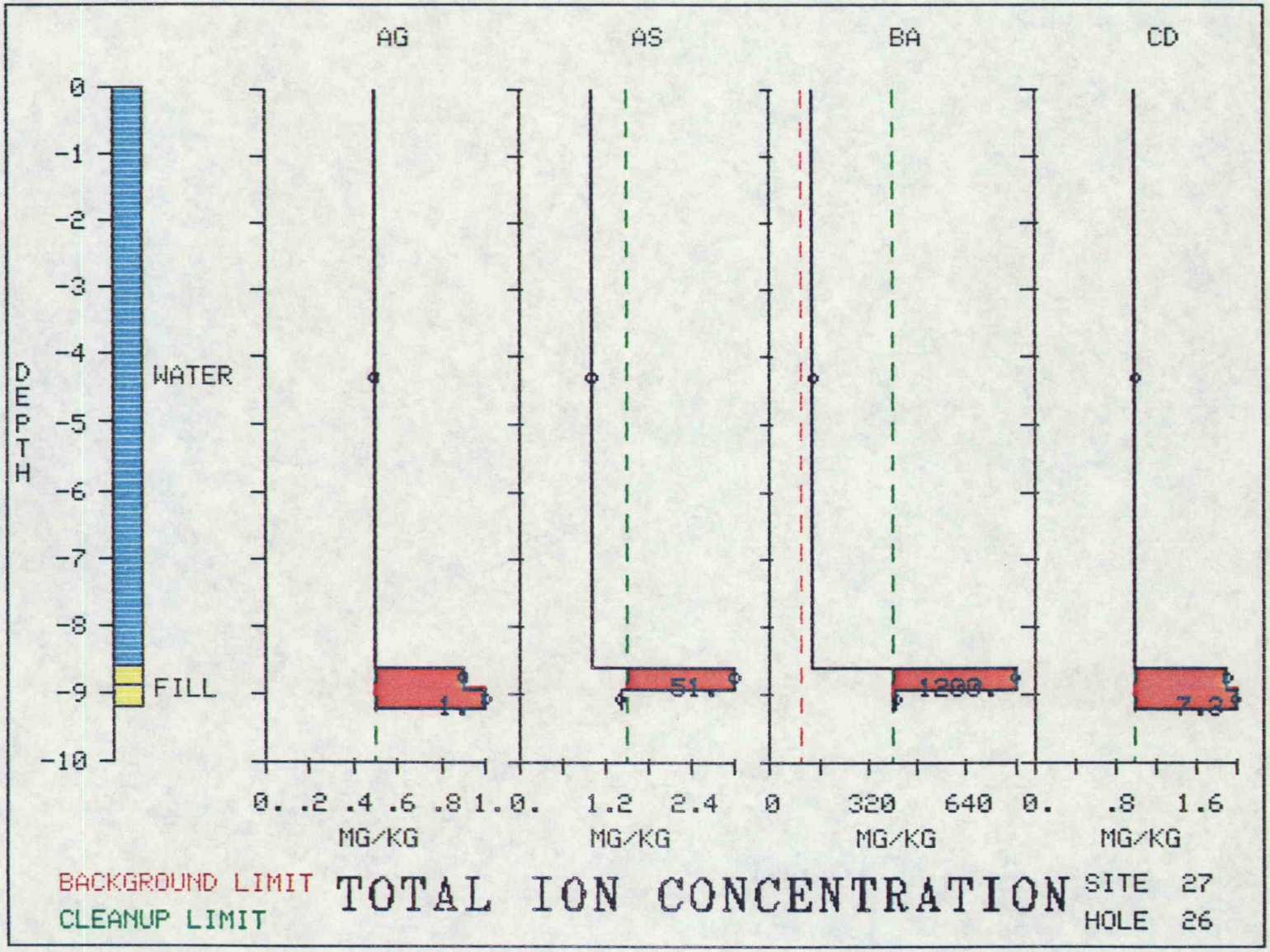
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
DEPTH
WATER
FILL
5500.
5500.
6.5
3.1
210.
52.
650.
4300.
0
320
640
0.
.8
1.6
0
8
16
24
32
400
8
16
24
32
40
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 25


ZN
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
DEPTH
WATER
FILL
.2000E+5
3400.
0 6 12 18 24 30
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 25


AG
AS
BA
CD
DEPTH
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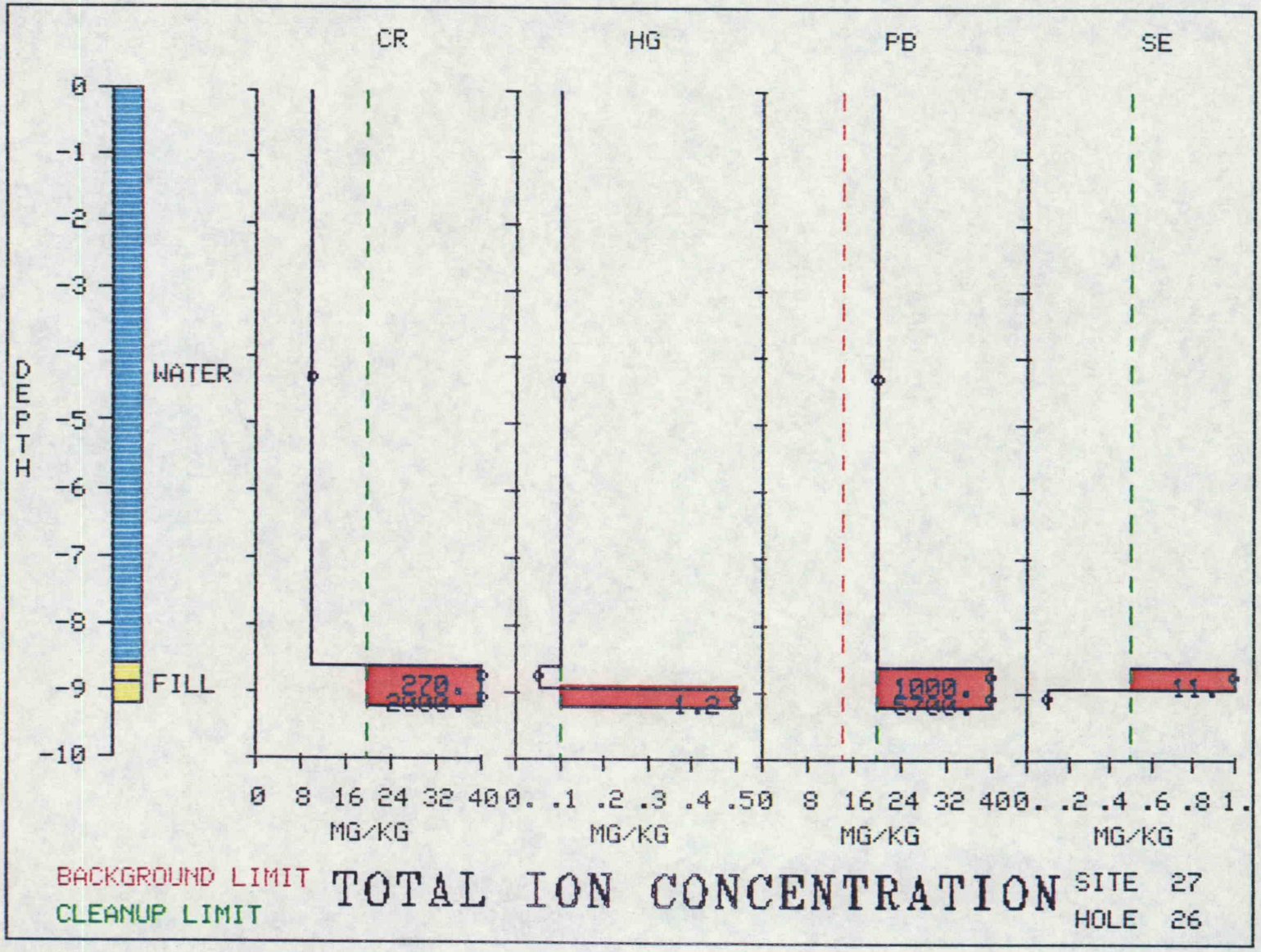
-2
-3
-4
-5
-6
-7
-8
-9
-10
WATER
FILL
1.
51.
1200.
7.2
0. .2 .4 .6 .8 1.0.
1.2 2.4
0 320 640
0. .8 1.6
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 26


CR
HG
PB
SE
DEPTH
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-3
-4
-5
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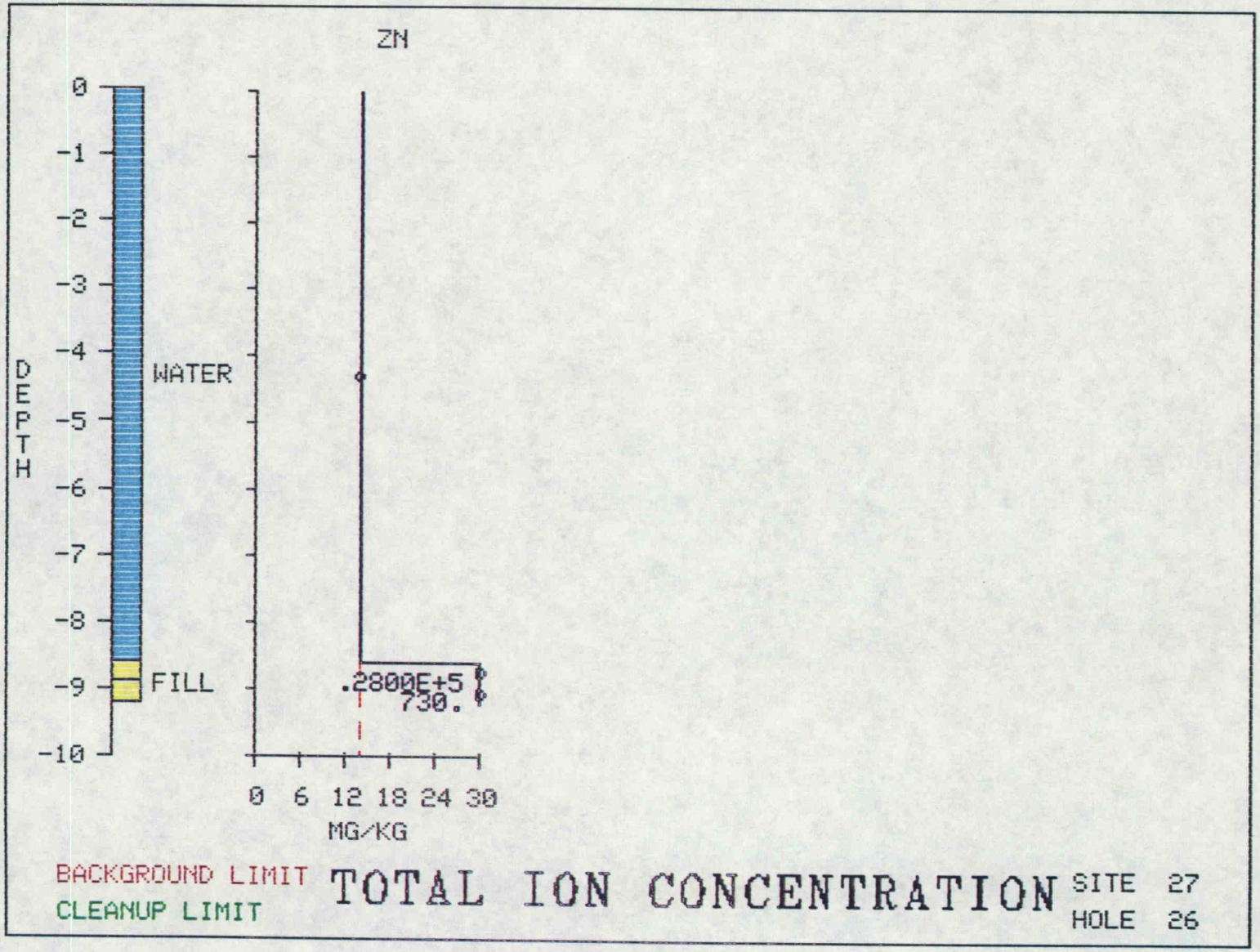
-7
-8
-9
-10
WATER
FILL
270.
1.2
1000.
11.
0 8 16 24 32 40
0. .1 .2 .3 .4 .5
8 16 24 32 40
0. .2 .4 .6 .8 1.
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 26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DEPTH
WATER
FILL
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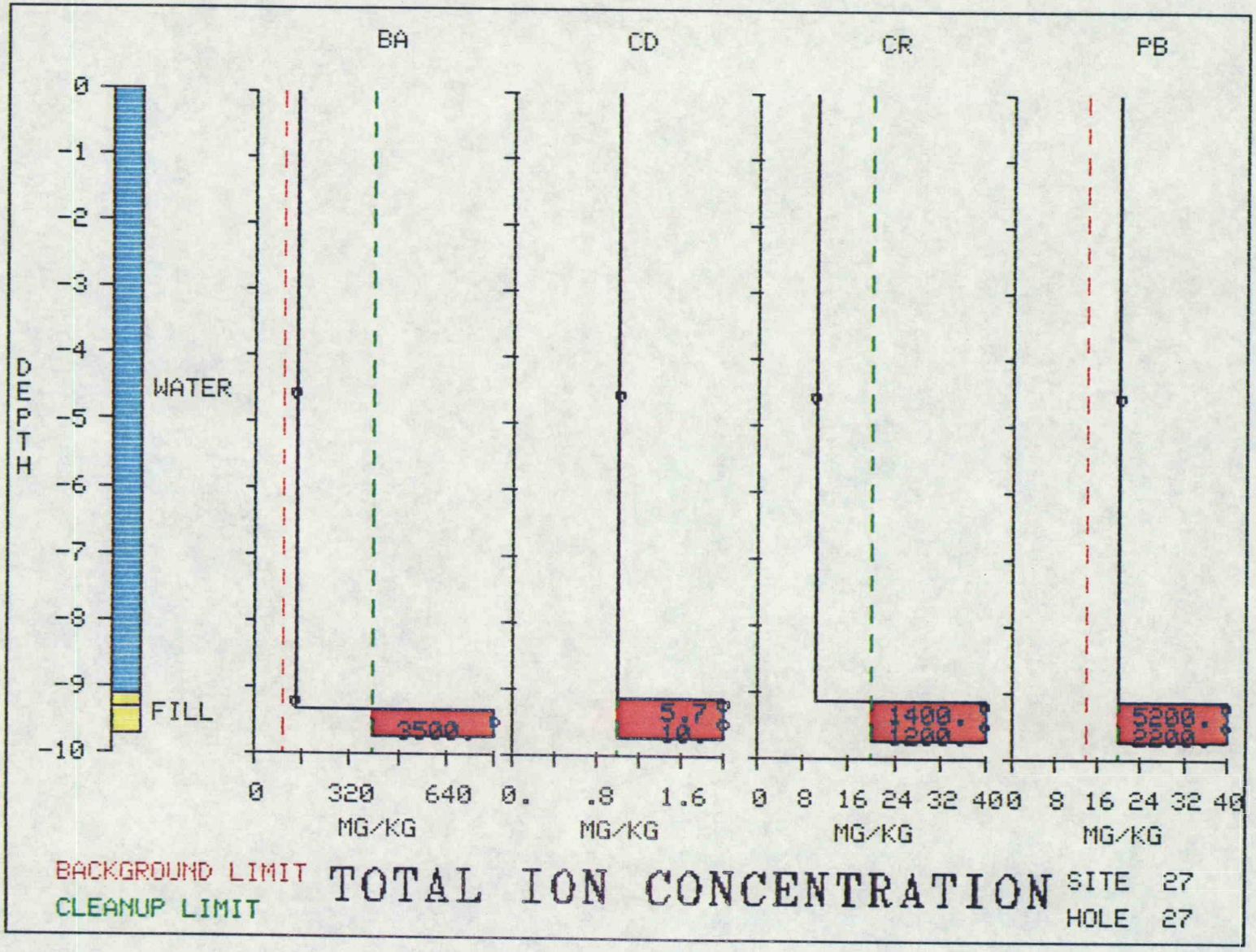
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 26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1200.
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2200.
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MG/KG
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BACKGROUND LIMIT
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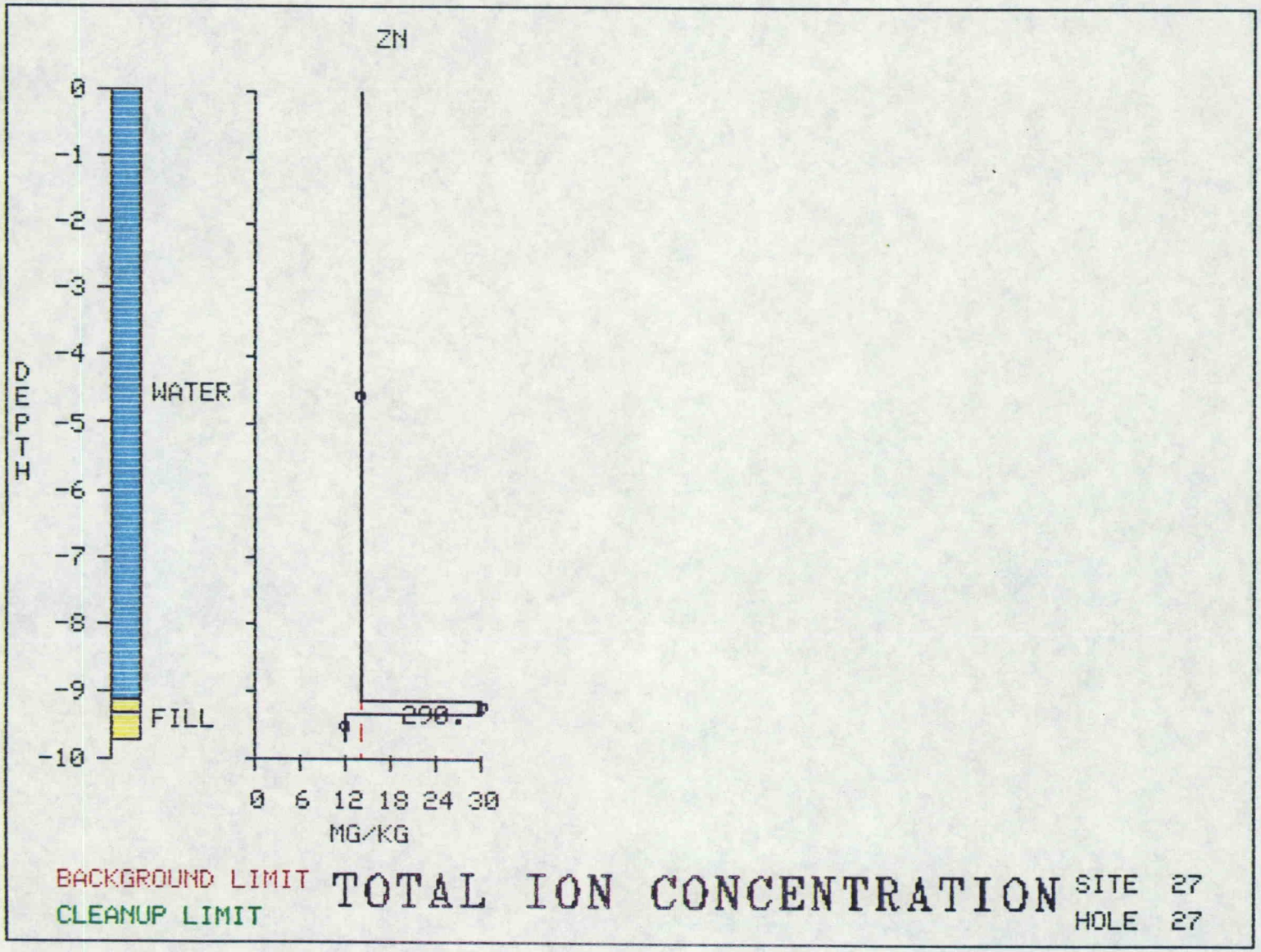
SITE 27
HOLE 27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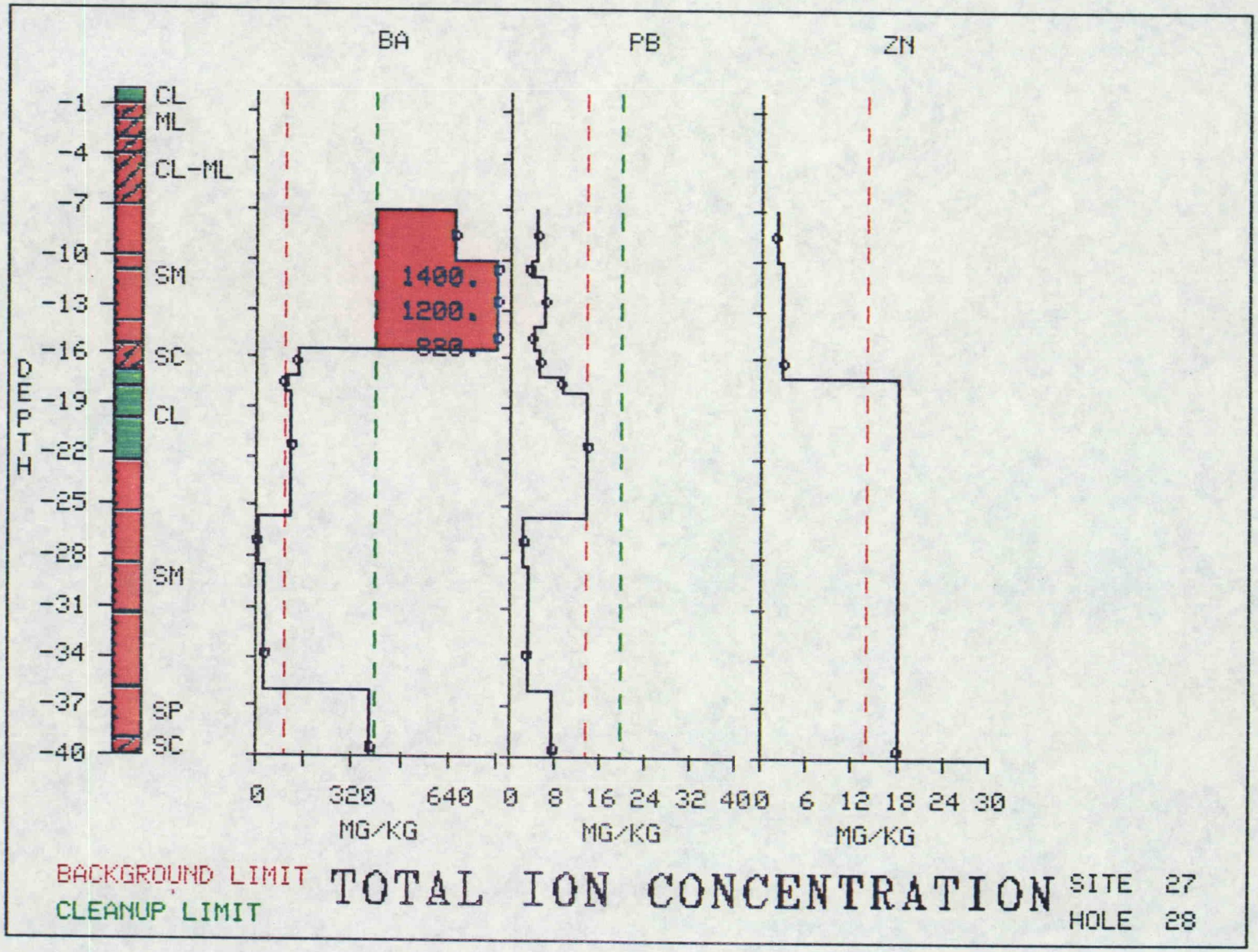
HOLE 27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CL-ML
SM
SC
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SM
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1200.
820.
0
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640
0
8
16
24
32
400
6
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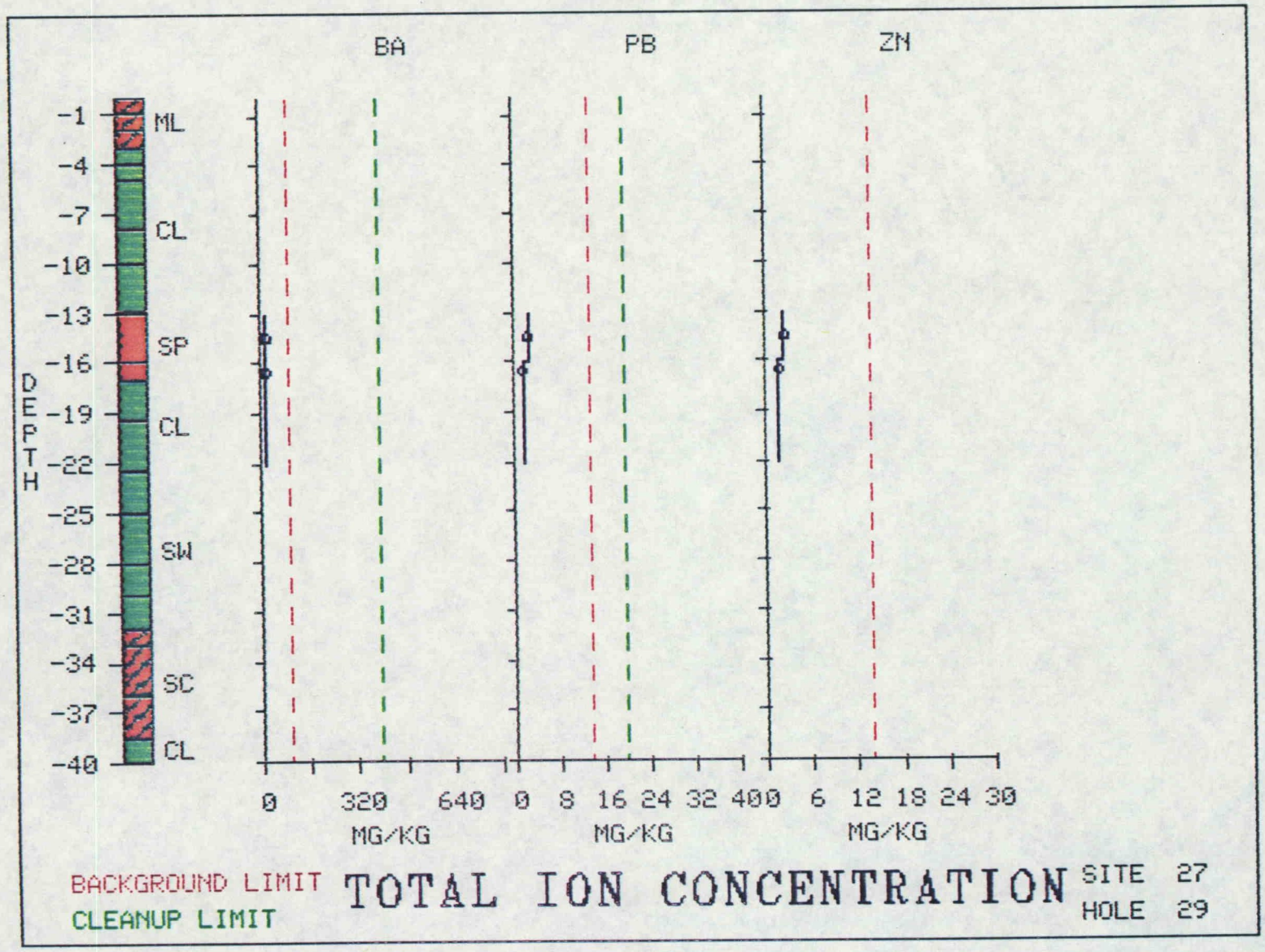
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 28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ML
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CL
SW
SC
CL
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24
32
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MG/KG
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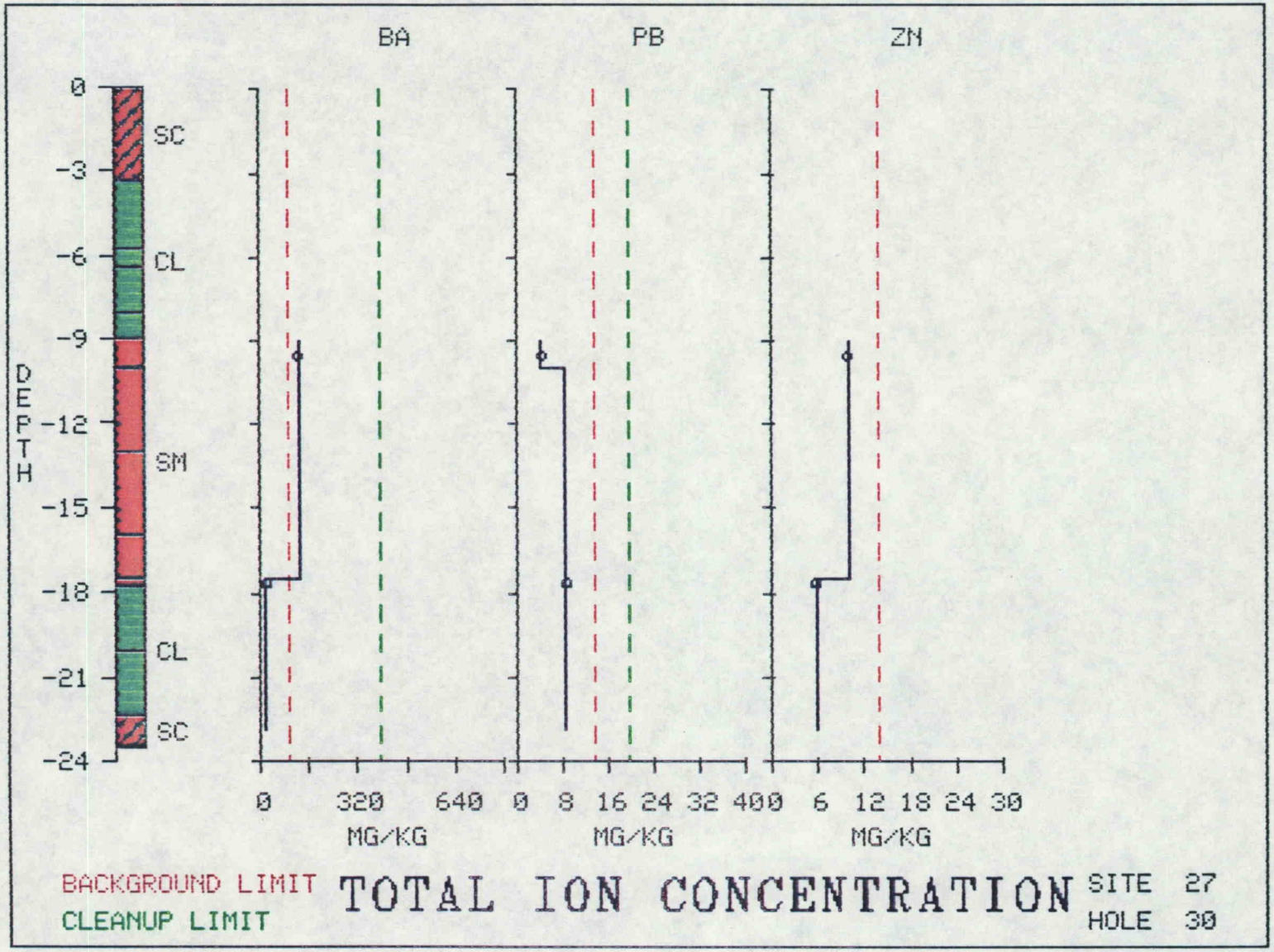
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 29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CL
SC
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16
24
32
400
6
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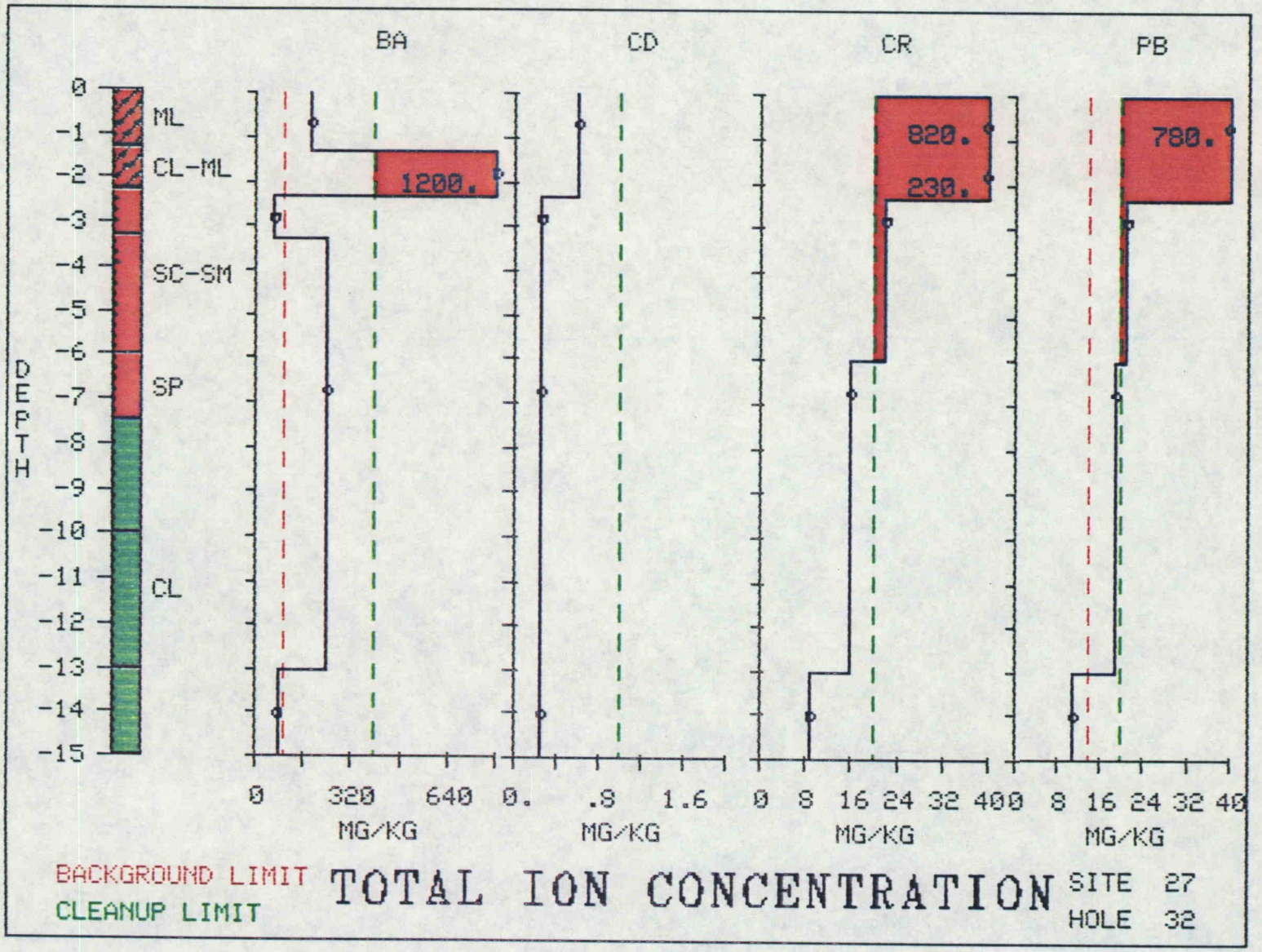
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 30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ML
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SC-SM
SP
CL
1200.
820.
230.
780.
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16
24
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400
8
16
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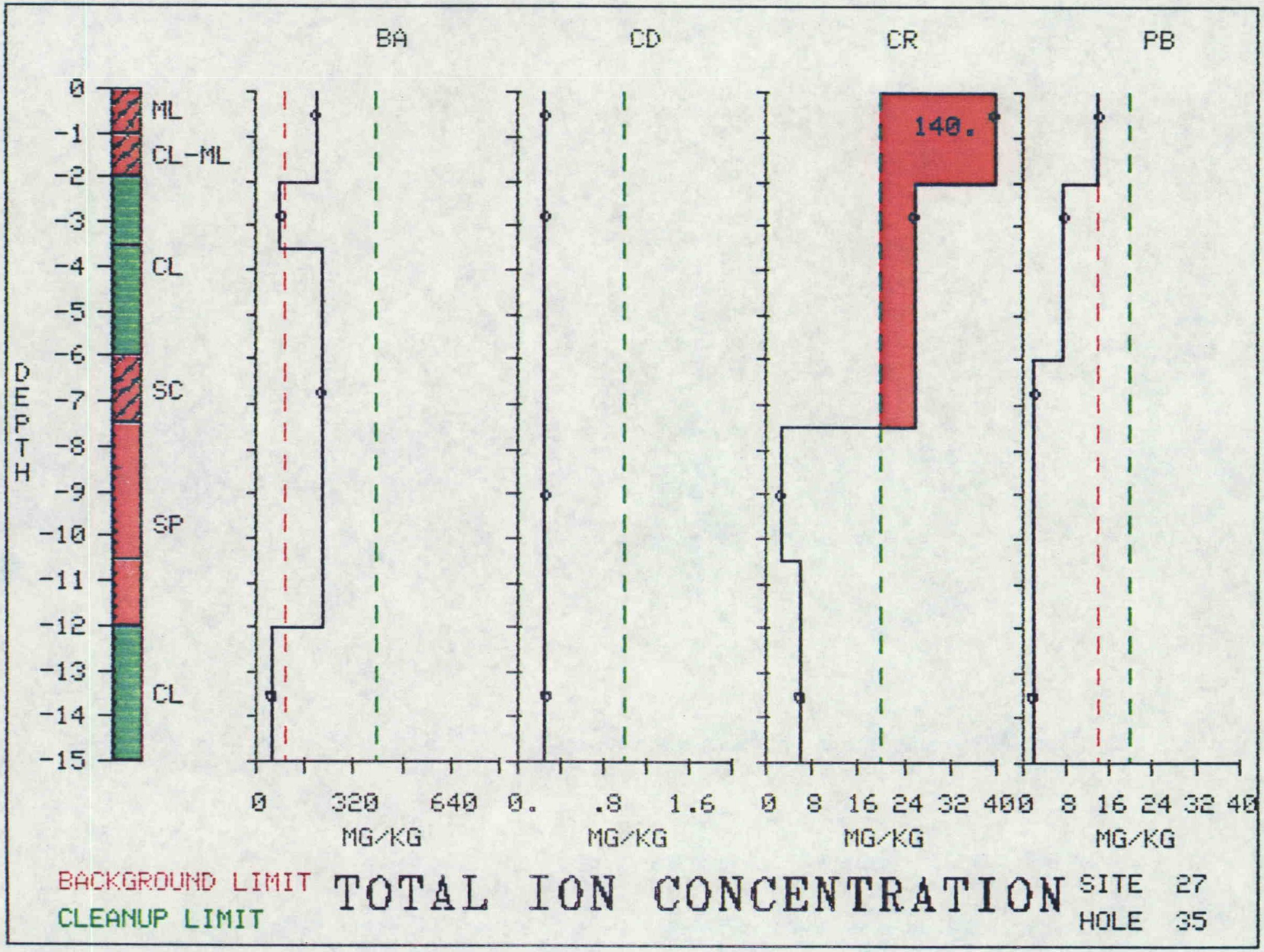
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 32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ML
CL-ML
CL
SC
SP
CL
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MG/KG
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1.6
MG/KG
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MG/KG
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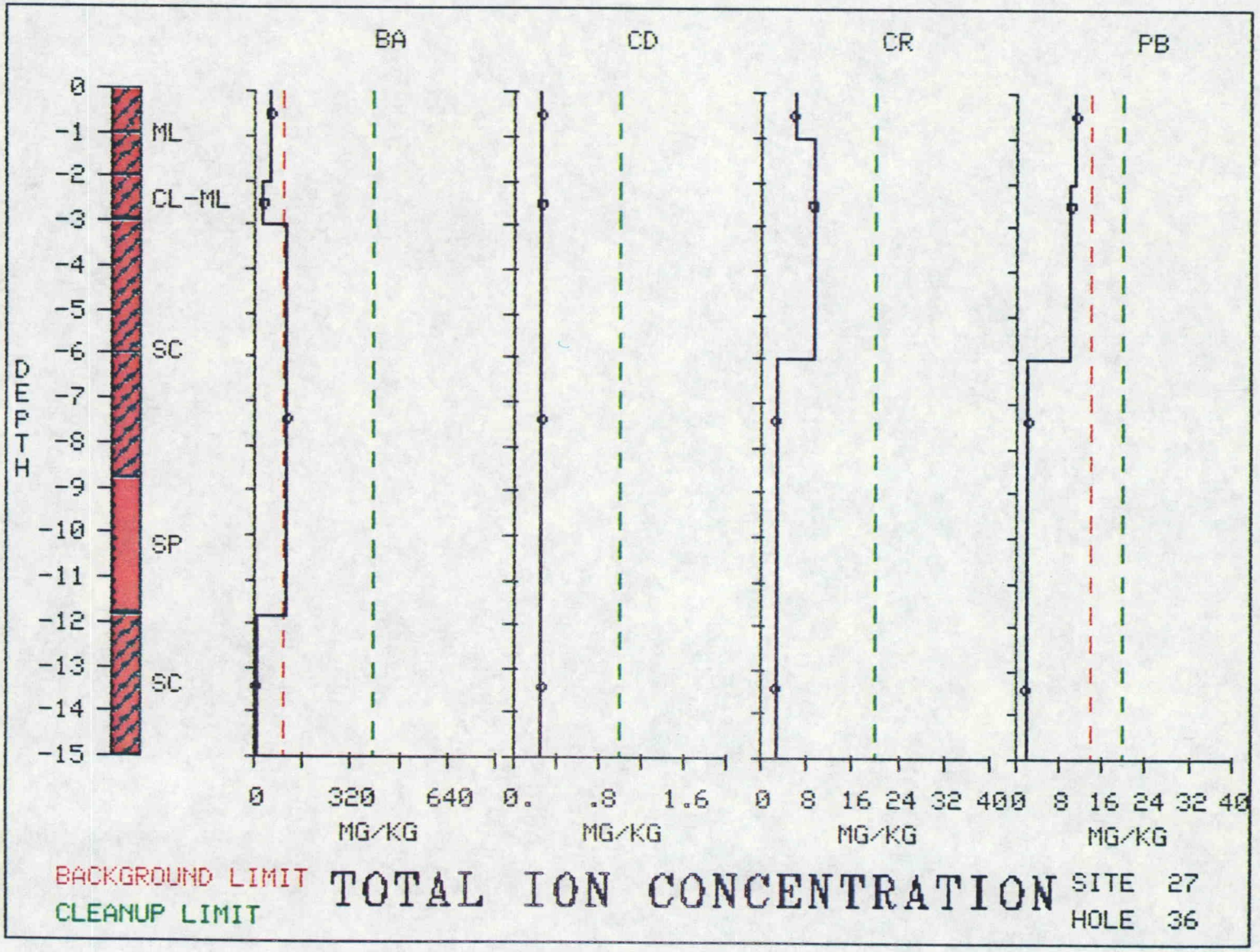
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 35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-12
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-14
-15
ML
CL-ML
SC
SP
SC
0
320
640
MG/KG
0.
.8
1.6
MG/KG
0
8
16
24
32
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MG/KG
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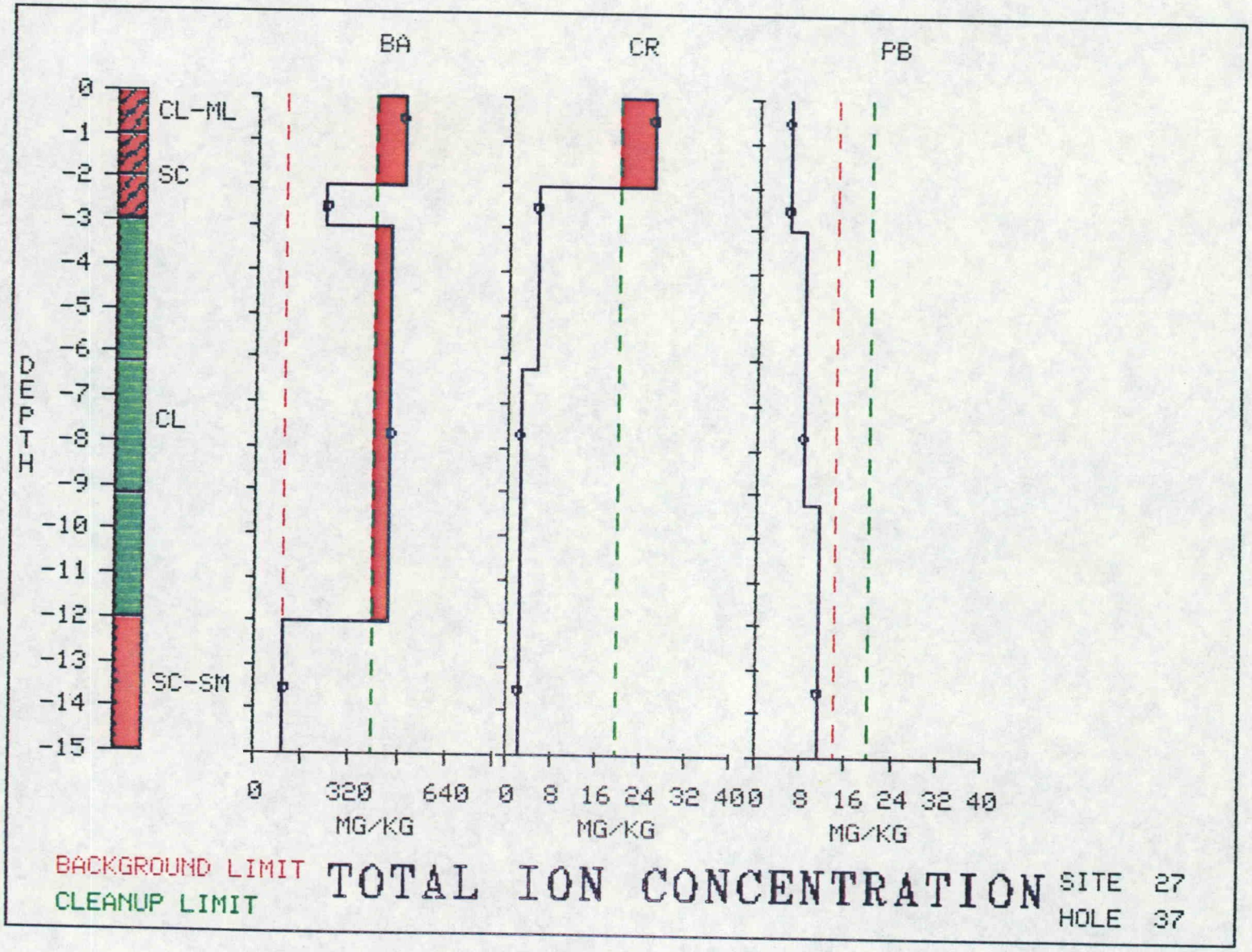
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 36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CL-ML
SC
CL
SC-SM
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16
24
32
400
8
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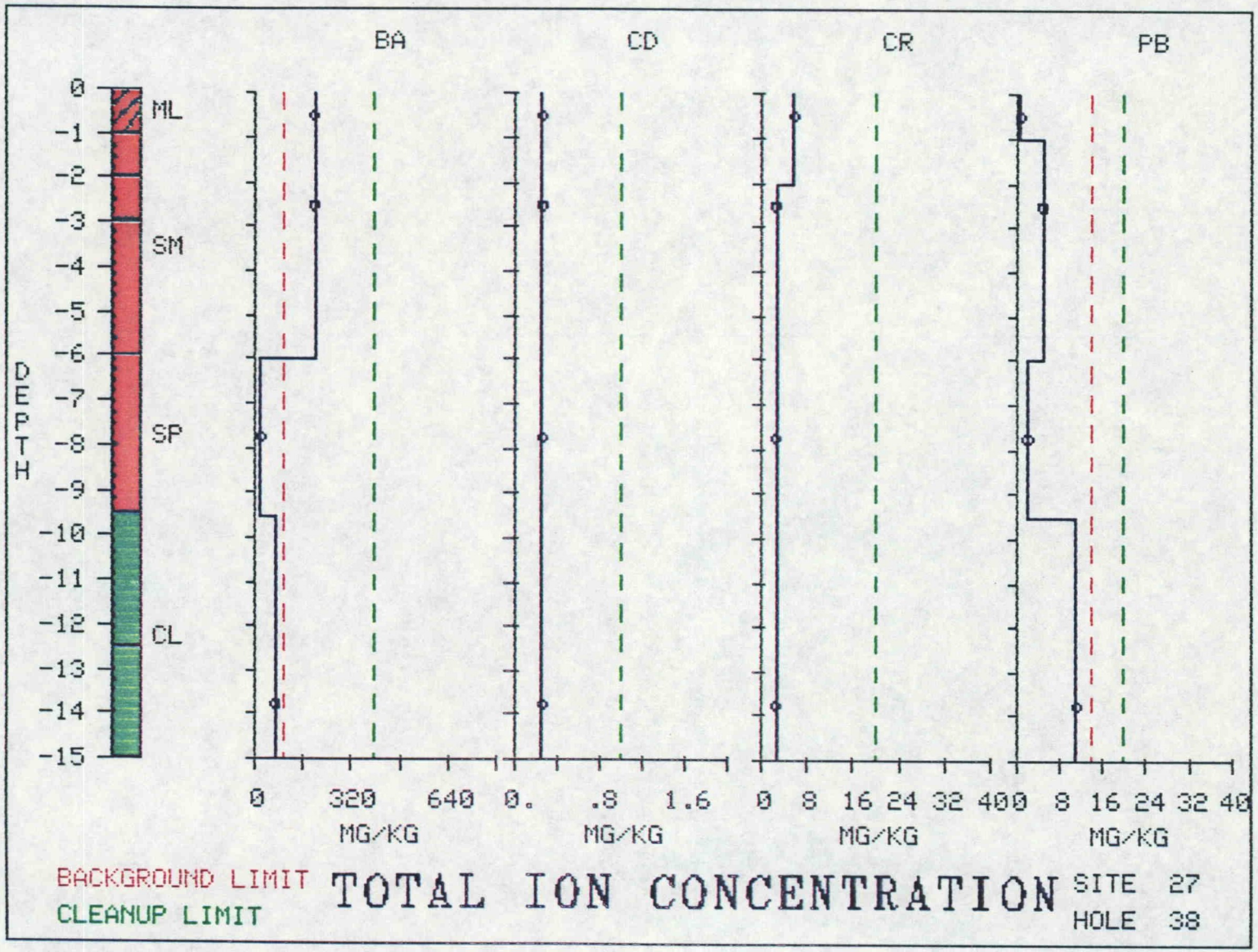
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 37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-15
ML
SM
SP
CL
0
320
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0.
.8
1.6
0
8
16
24
32
400
8
16
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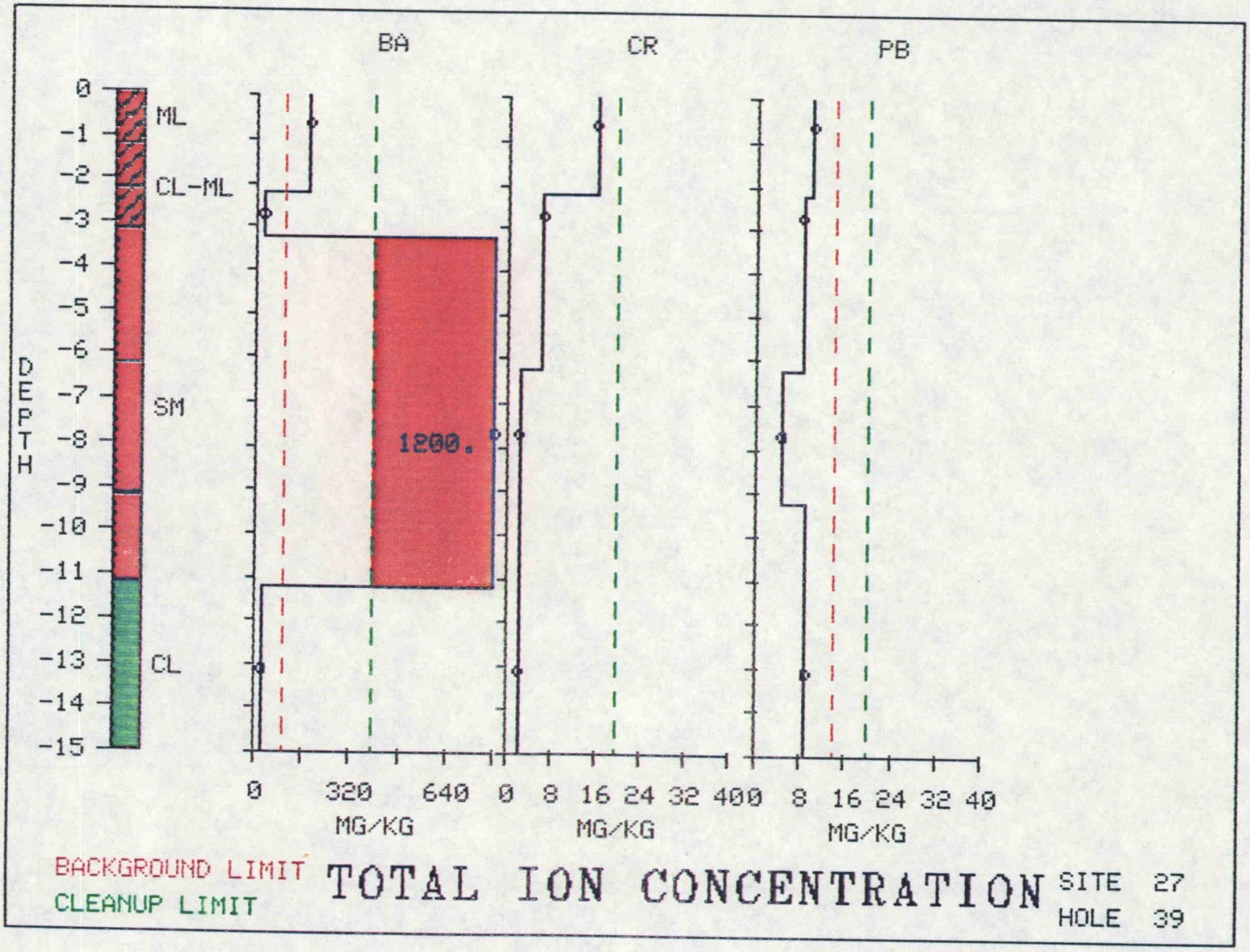
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 38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-14
-15
ML
CL-ML
SM
CL
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0
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16
24
32
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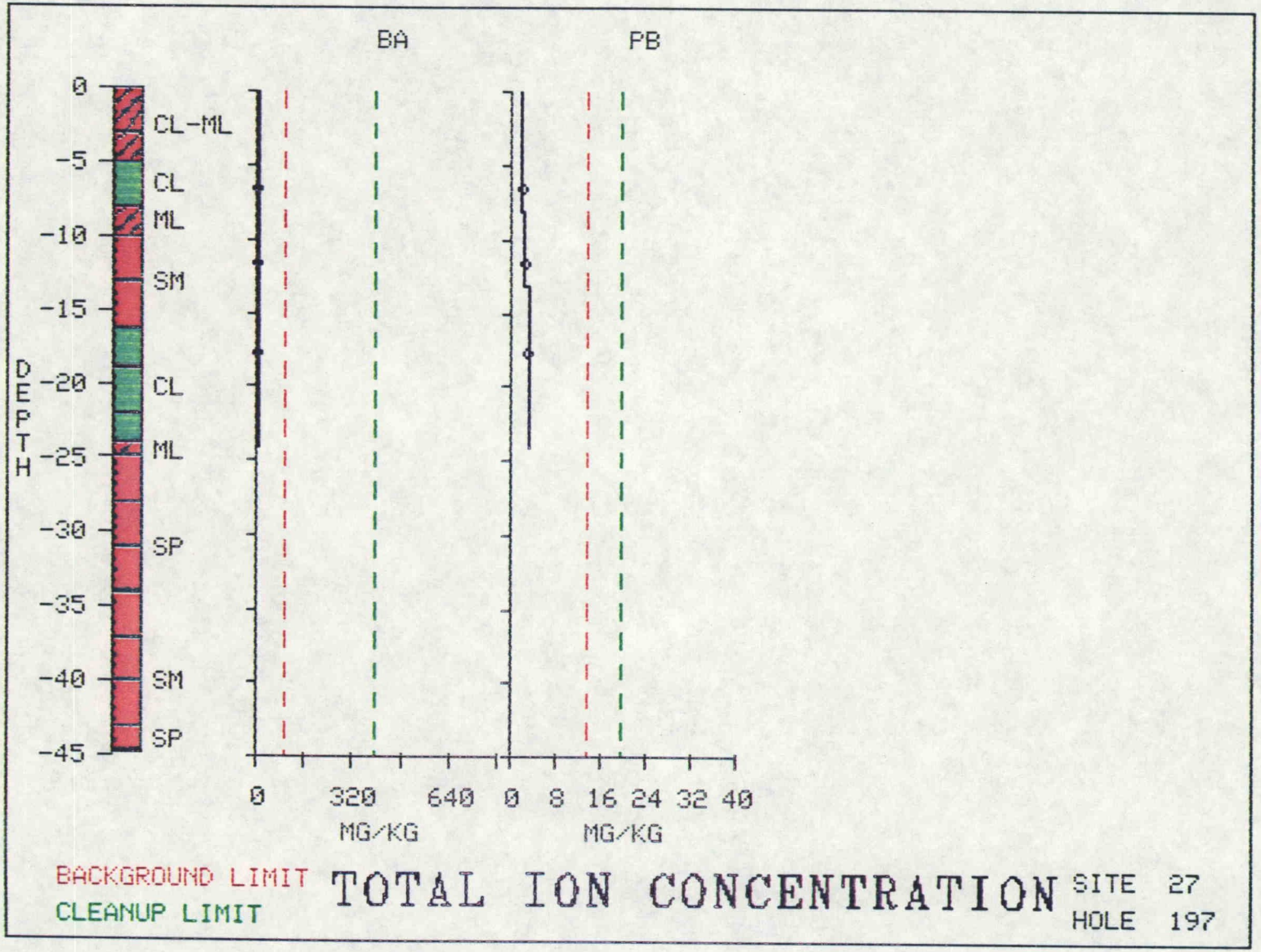
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 39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DEPTH
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SM
CL
ML
SP
SM
SP
0
320
640
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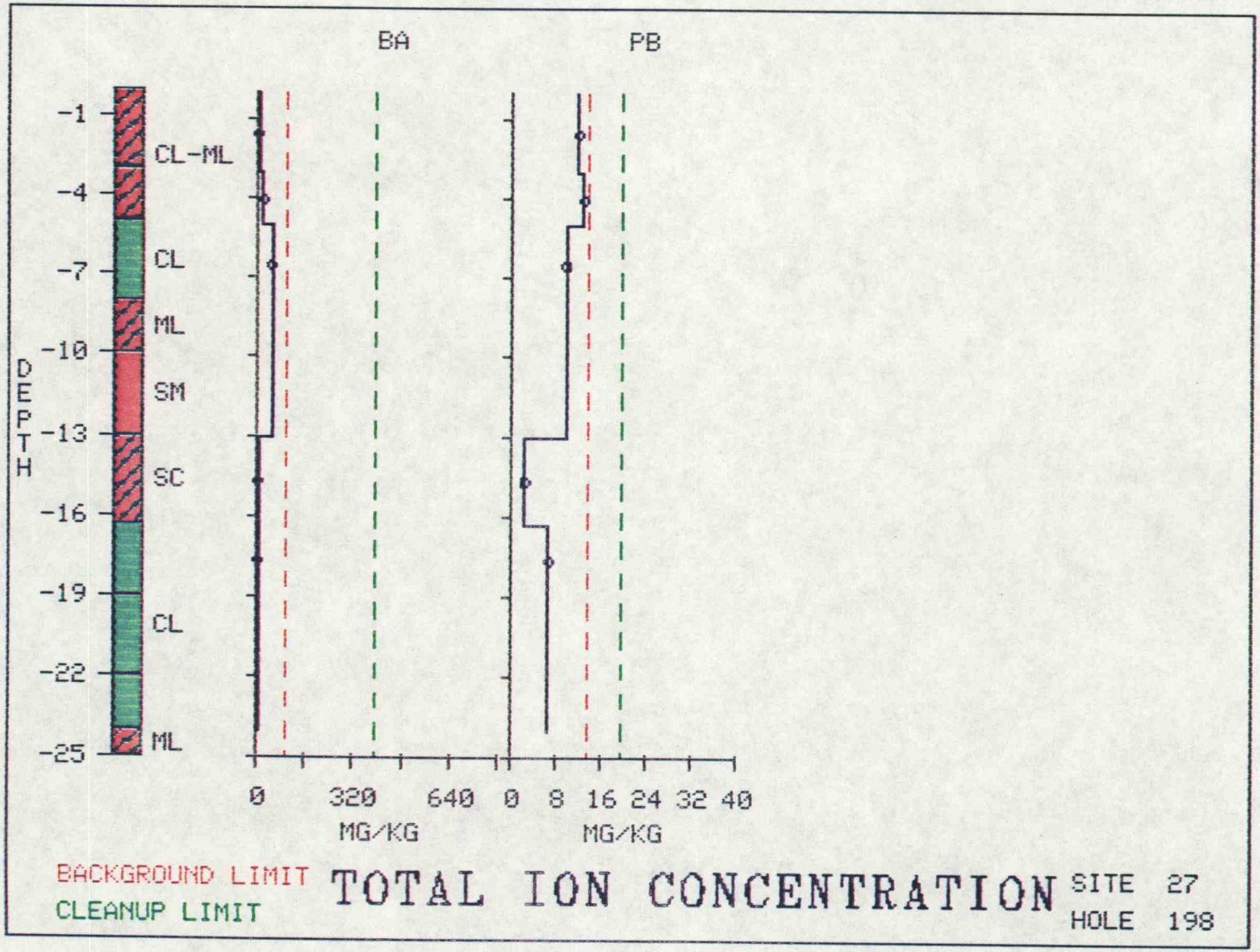
32
40
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 197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CL-ML
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ML
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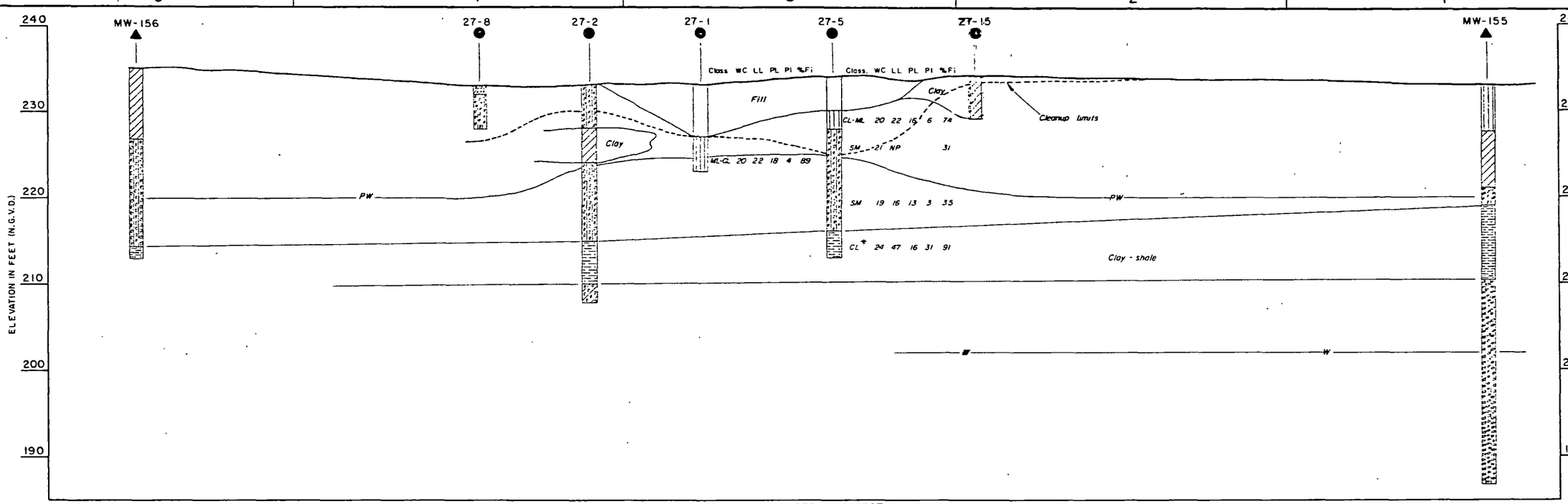
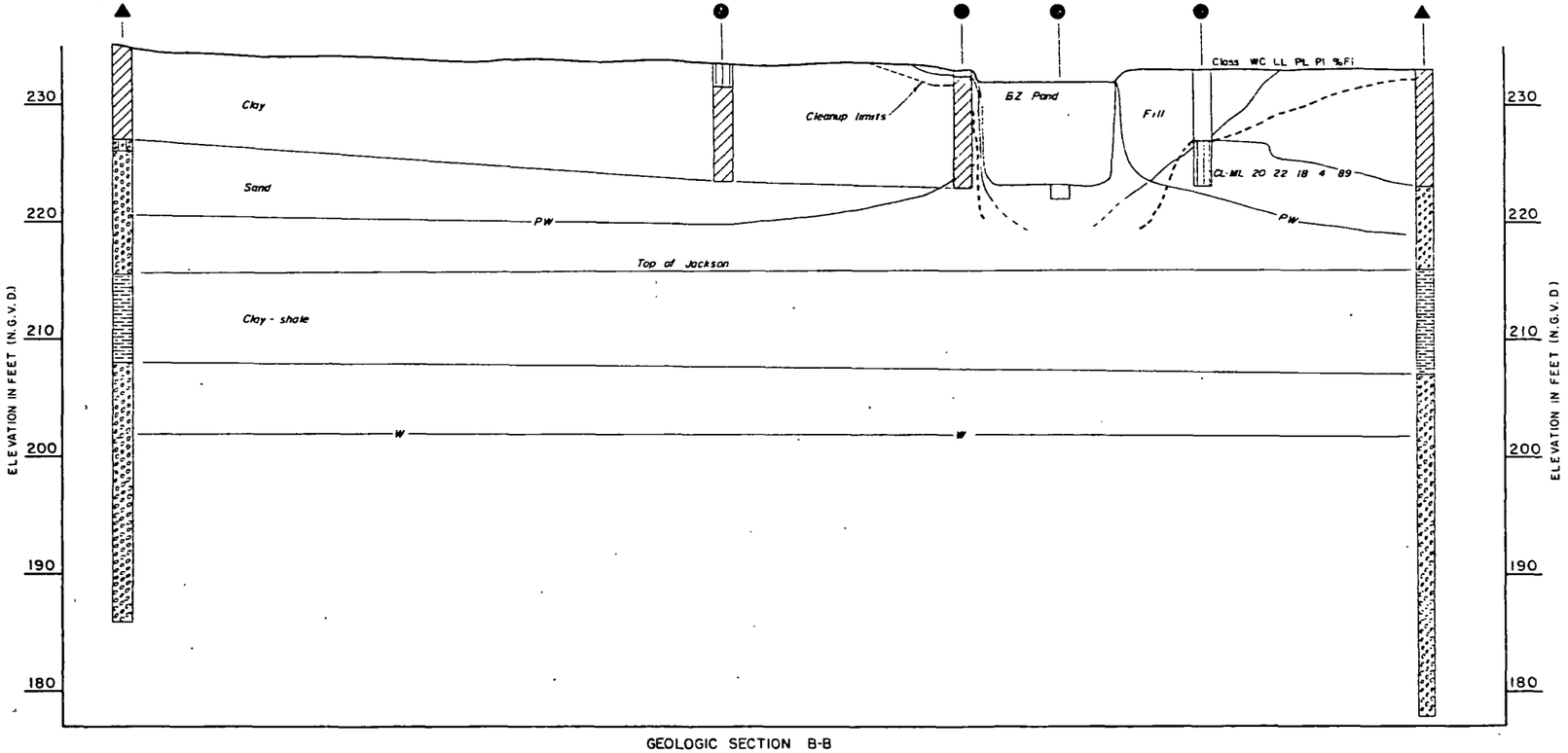
SC
CL
ML
0
320
640
0
8
16
24
32
40
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 27
HOLE 198

DRAWINGS



GEOLOGIC SECTION A-A



GEOLOGIC SECTION B-B

LEGEND

- AUGER HOLE
- MONITORING WELL
- SOIL CLASSIFICATION PERFORMED ON CLAY-SHALE
- -W- WATER TABLE
- -PW- PERCHED WATER
- LIMITS OF CONTAMINATION

- FILL MATERIAL
- CL, LOW PLASTICITY CLAY
- CH, HIGH PLASTICITY CLAY
- SC, CLAYEY SAND
- CL-ML, SILT, CLAYEY SILT
- SM, SILTY SAND
- SP, SAND
- CLAY-SHALE

Class UNIFIED SOIL CLASSIFICATION SYSTEM
WC WATER CONTENT
LL LIQUID LIMIT
PL PLASTIC LIMIT
PI PLASTICITY INDEX
%FI PERCENT FINES

SCALE IN FEET
20 0 20 40

Revisions			
Symbol	Description	Date	Approved

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
TULSA, OKLAHOMA

Designed by: Cameron E. Thomas
Drawn by: Darrell Jones
Checked by:
Submitted by:
Chief Geotechnical Branch

PINE BLUFF ARSENAL
PINE BLUFF, ARKANSAS
PN-83 FY-86
HAZARDOUS LANDFILL/CLOSURE SITES

SITE. 27

GEOLOGIC SECTIONS A-A, B-B

Scale: As Shown
Date:
Dwg Code:
Sheet reference number: 4
Sheet of

5 4 3 2 1

D C B A

E 1,923,000 E 1,981,000 E 1,923,500 E 1,981,500 E 1,924,000

N 12,450,500 N592,000 N 12,450,000 N591,500

X 235.3 X 235.8 X 235.5 X 238.8 236.4 X 236.2 238.3 X 235.4 X 236.3 236.1 X 232.5 X 233.0 232.8 X 233.2 232.5 X 238.4 X 238.2 234.1 X 238.5 234.3 X 238.7 234.3 X 236.7 239.5 X 237.2 X 239.0 238.6 X 239.2 X 234.8 238.5 X 235.8 238.7 X 233.2 238.6 X 235.0 238.6 X 238.8 237.2 X 238.6 X 238.6 X 239.2 X 238.2

235 230 237

27-1 27-2 27-3 27-4 27-5 27-6 27-7 27-8 27-9 27-10 27-11 27-12 27-13 27-14 27-15 27-16 27-17 27-18 27-21 27-22 27-23 27-24 27-25 27-26 27-27 27-28 27-29 27-30 27-32 27-35 27-36 27-37 27-38 27-39

MW-154 MW-155 MW-156 MW-157 MW-197 MW-198 CM-1 CM-2 M.H.

LEGEND

- Auger hole
- Control monument
- Monitoring well
- Abandoned monitoring well
- Denison hole

SCALE IN FEET

50 0 50 100

Revisions			
Symbol	Descriptions	Date	Approved

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
TULSA OKLAHOMA

Designed by
Drawn by
Checked by
Submitted by
Chief Geotechnical Branch

PINE BLUFF ARSENAL
PINE BLUFF, ARKANSAS
PN. 83 FY. 86
HAZARDOUS LANDFILL / CLOSURE SITES

SITE 27
PLAN OF EXPLORATION

Scale As Shown
Date
Dwg Code
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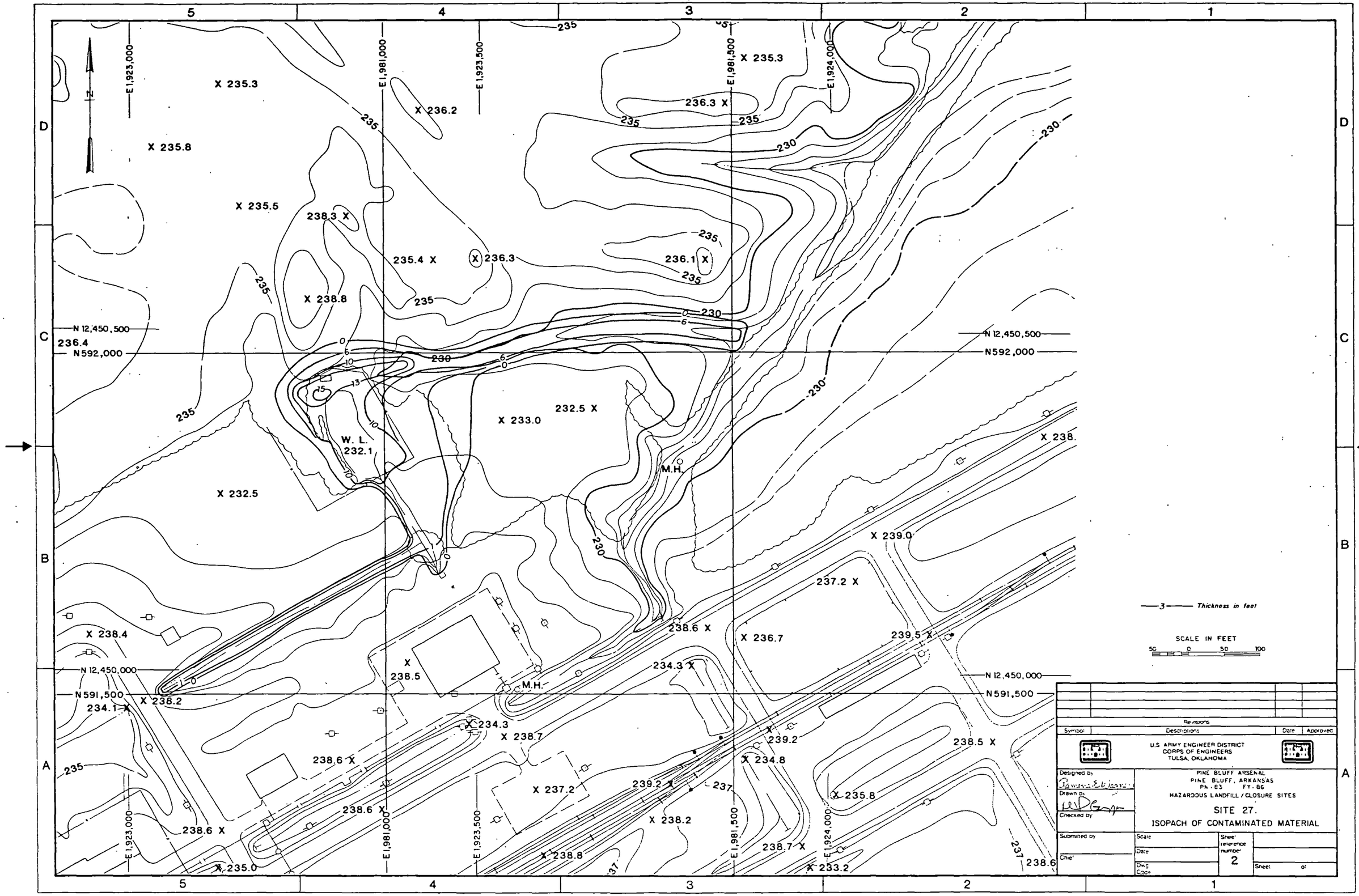
5
4
3
2
1
A
B
C
D
N
E 1,923,000
E 1,981,000
E 1,923,500
E 1,981,500
E 1,924,000
N 12,450,000
N592,000
N591,500
X 235.3
X 236.2
X 235.8
X 235.5
238.3 X
235.4 X
X 236.3
236.1 X
X 238.8
236.4
X 232.5
X 233.0
232.5 X
W. L.
232.1
M.H.
X 238.
X 239.0
237.2 X
238.6 X
X 236.7
239.5 X
234.3 X
X 238.4
234.1
X 238.2
X 238.5
X 234.3
X 238.7
239.2 X
238.5 X
X 234.8
X 237.2
239.2 X
X 235.8
238.6 X
X 238.2
238.7 X
X 238.8
X 235.0
X 233.2
238.6
235
230
237
3 Thickness in feet
SCALE IN FEET
50 0 50 100
Revisions
Symbol
Description
Date
Approved
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
TULSA, OKLAHOMA
Designed by
Drawn by
Checked by
Submitted by
Chief
PINE BLUFF ARSENAL
PINE BLUFF, ARKANSAS
PH-83 FY-86
HAZARDOUS LANDFILL / CLOSURE SITES
SITE 27.
ISOPACH OF CONTAMINATED MATERIAL
Scale
Date
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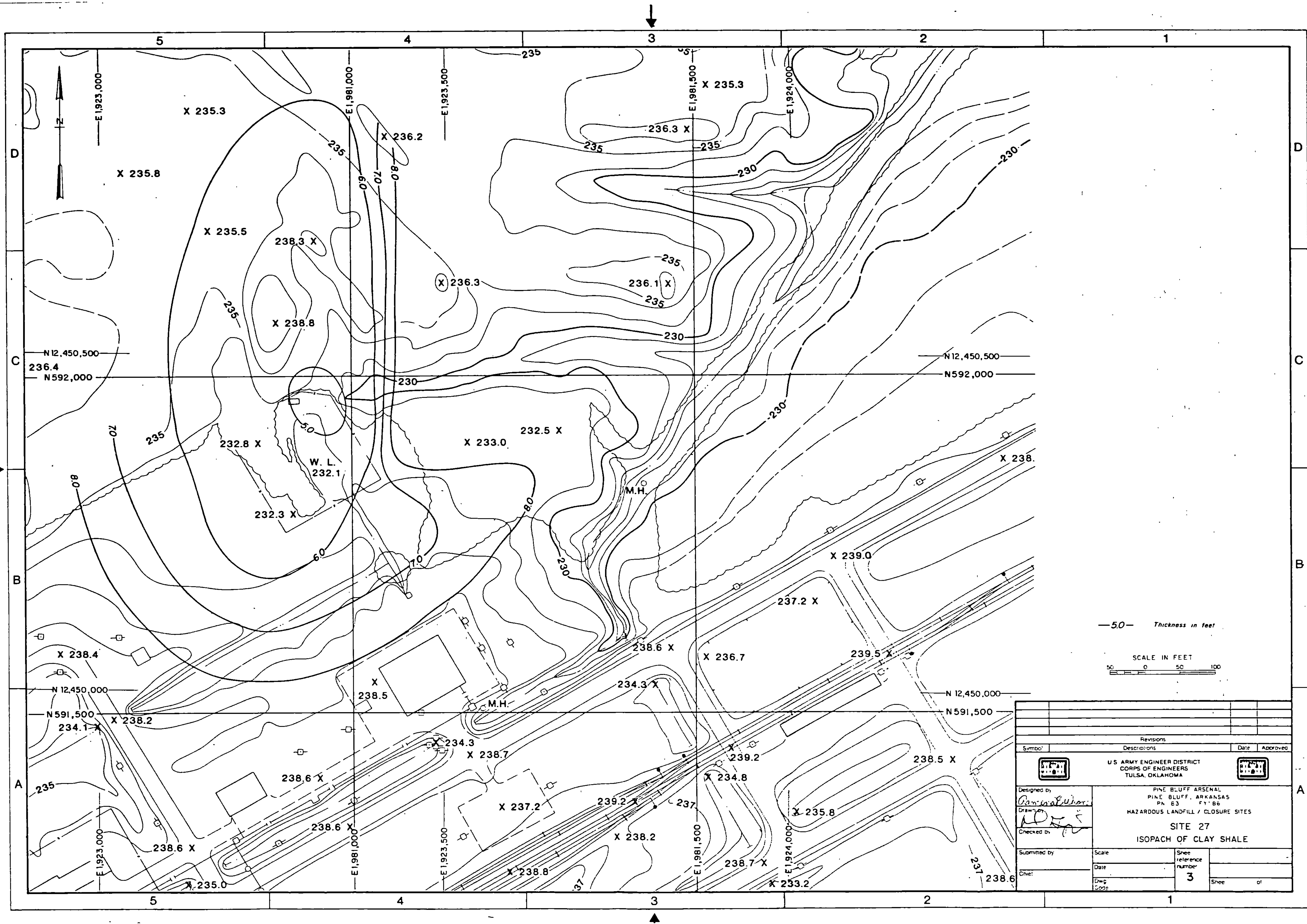
-5.0- Thickness in feet
SCALE IN FEET
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N592,000
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E1,981,000
E1,923,500
E1,981,500
E1,924,000
W. L. 232.1
M.H.
Revisions
Symbol Descriptions Date Approved
U S ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
TULSA, OKLAHOMA
Designed by
Drawn by
Checked by
PINE BLUFF ARSENAL
PINE BLUFF, ARKANSAS
PN 83 FY 86
HAZARDOUS LANDFILL / CLOSURE SITES
SITE 27
ISOPACH OF CLAY SHALE
Submitted by
Chief
Scale
Date
Dwg Code
Sheet reference number
3
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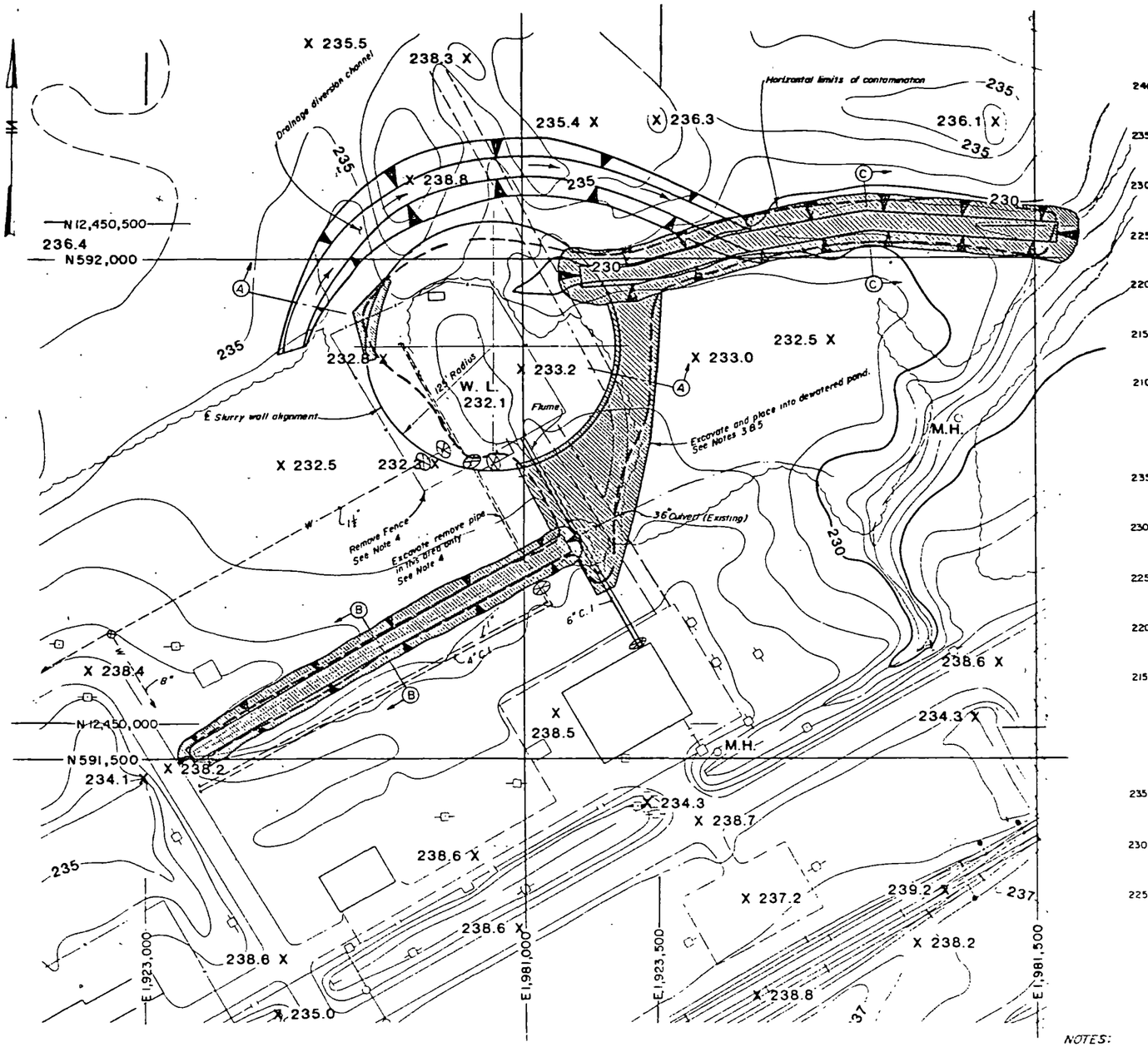

PLAN
(BZ POND)
SCALE OF FEET
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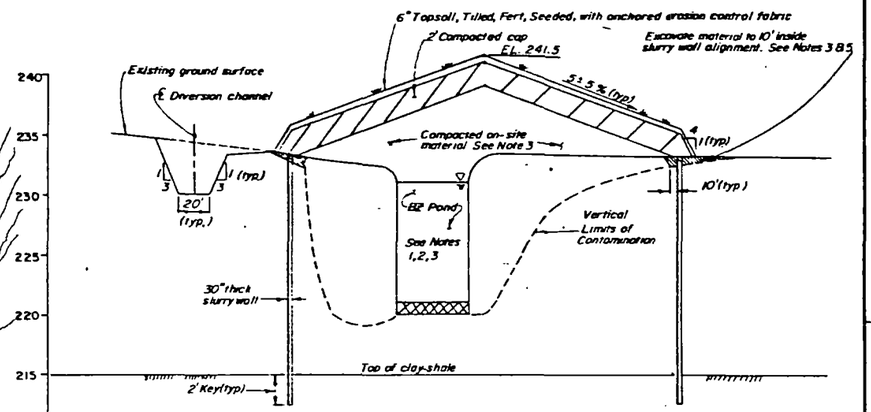
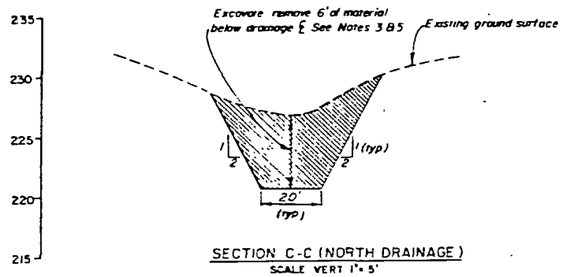
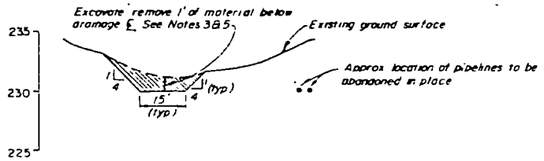


SECTION A-A (Post-Closure)
SCALE VERT 1"=5'
HORIZ 1"=40'



SECTION C-C (NORTH DRAINAGE)
SCALE VERT 1"=5'
HORIZ 1"=20'



SECTION B-B (SOUTH DRAINAGE)
SCALE VERT 1"=5'
HORIZ 1"=20'

NOTES:
1. Pond to be dewatered by pumping to overland natural drainage
2. Pond sediments to be excavated, solidified and disposed of hazardous waste landfill
3. Contaminated material outside slurry wall alignment to be excavated and used as backfill for dewatered pond.
4. All fences, excavated pipe, and misc structural debris to be disposed in dewatered pond
5. All areas excavated to be backfilled to pre-closure elevations with uncontaminated compacted random fill.

LEGEND
- Contaminated material to be excavated
- Existing buried pipelines
- Pipelne to be capped
- Pond sediments

Revisions			
Symbo	Descriptions	Date	Approved

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
TULSA, OKLAHOMA

Designed by
Drawn by
Checked by
Submitted by
Chief

PINE BLUFF ARSENAL
PINE BLUFF, ARKANSAS
PN 83 FY'86
HAZARDOUS LANDFILL/CLOSURE SITES

BZ POND CLOSURE PLAN & SECTIONS

Scale As Shown
Date NOV. 1984
Dwg Code
Sheet reference number 5
Sheet: of